Airbus A319/A320/A321 (PW1100G & CFM LEAP) - "NEO"
TECHNICAL TRAINING MANUAL
MECHANICAL & AVIONICS COURSE - T1+T2 (Level 1, 2 & 3)

CFM LEAP-1A/IAE PW1100G Airframe Differences

A320NEO-B12-0009.1, Revision 5, Monday, 18 June 2018

Airbus A319/A320/A321 (IAE PW1100G/CFM LEAP-1A)

Part-66, Appendix III, Level 3 Training

These notes have been prepared by the Storm Aviation Training Centre to provide a source of reference during your period of training.

They will be useful to you during your training, but I must emphasise that the appropriate Approved Technical Publications (ATPs) must always be used when you are actually working on the aircraft.

We always aim to ensure that these documents are as accurate as possible, however if you notice any items which require amending, please inform the Training Manager or Instructor so that any amendments may be incorporated before the next course.

I trust your course with us will be informative and enjoyable.

Ben Greenaway, Training Manager, UK.147.0057

Note: These notes are the differences for the NEO from the CEO (A320 Family CFM56/V2500) or from either NEO engine type.

Note for Instructors: The instructor must only deliver the applicable sections to the course being delivered.

Revision Summary

Part-66, App III Level	Revision and Date	Summary of Revision
3	R1, 01 Feb 2017	Initial Issue.
3	R2, Monday, 22 May 2017	LEAP-1A additions.
3	R3, Monday, 04 September 2017	Corrections to Ice & Rain protection.
3	R4, Monday, 01 January 2018	Differences split into engines. Corrections to schematics. Oxy option added.
3	R5, Monday, 18 June 2018	Diagrams updated. Minor differences (options) added.

Table of Contents

Acronyms

- BUSS - BACK-UP SPEED SCALE
- ROP - Runway Overrun Protection
- ROPS - Runway Overrun Protection System
- ROW- Runway Overrun Warning
- RAWS - Terrain Awareness and Warning System
- T/TISS - Traffic and Terrain Integrated Surveillance System
- TMS - Thermal Management System

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NEO DIFFERENCES ALL – IAE PW1100G AND CFM LEAP-1A

Note for Instructors: The instructor must only deliver the applicable sections for the course being delivered.

MINOR DIFFERENCES TO AVIONIC SYSTEMS (LEAP-1A & PW1100G) - Level 3

Runway Overrun Protection (ROP) - Option

General

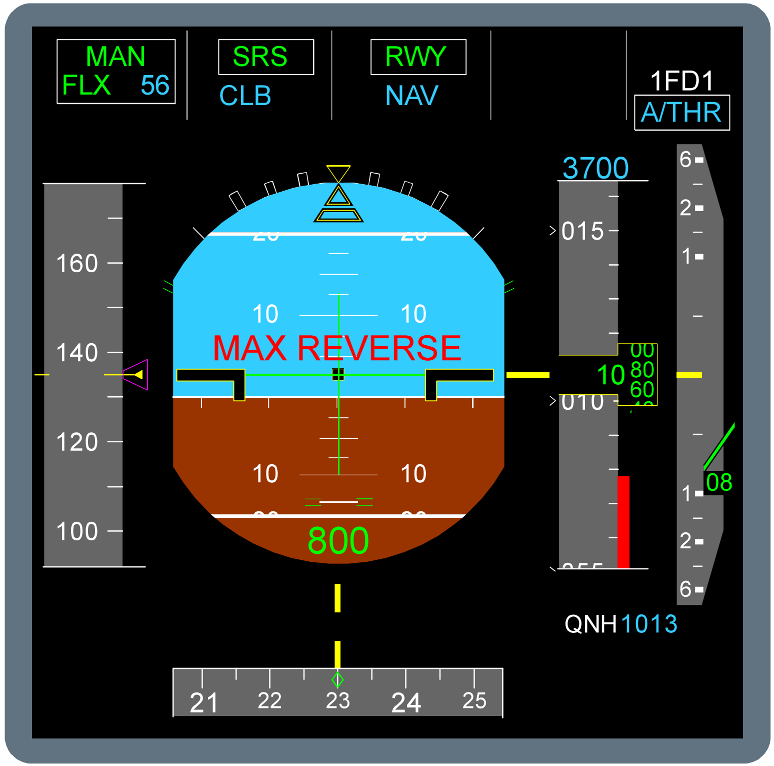
Runway Overrun Protection (ROP) is provided by the Runway Overrun Prevention System (ROPS). This function is a safety enhancement for all Braking modes (manual and automatic) and at landing that protects against the risk of overrunning the runway. The goal is to help the flight crew anticipating an overrun risk during the landing phase by computing in real time the braking distances and compares them to the Landing Distances Available (LDA).

In case of detected runway overrun situation, i.e. if this (these) computed landing distance(s) exceed(s) the runway length, the ROPS function warns or activates:

- In short final approach, Runway Overrun Warning (ROW) triggers alerts (PFD messages and aural alert) to help the crew to decide a go-around manoeuvre if needed.
- During landing roll:
  - Runway Overrun Protection (ROP) triggers alerts (dedicated red PFD messages and aural alert) warning the pilots to brake with full pedals.
  - ROP triggers alerts (dedicated red PFD messages and aural alert) inducing to select or keep max reverse without delay. These alerts are reversible if the runway overrun risk is no longer detected.

Note: The ROPS may also be installed as a SB under modification on the CEO & NEO fleets.

RUNWAY OVERRUN PREVENTION SYSTEM (ROPS) - INTRODUCTION



PFD (MAX REVERSE MESSAGE) TYPICAL

Operation

ROPS computation is performed by the FAC.

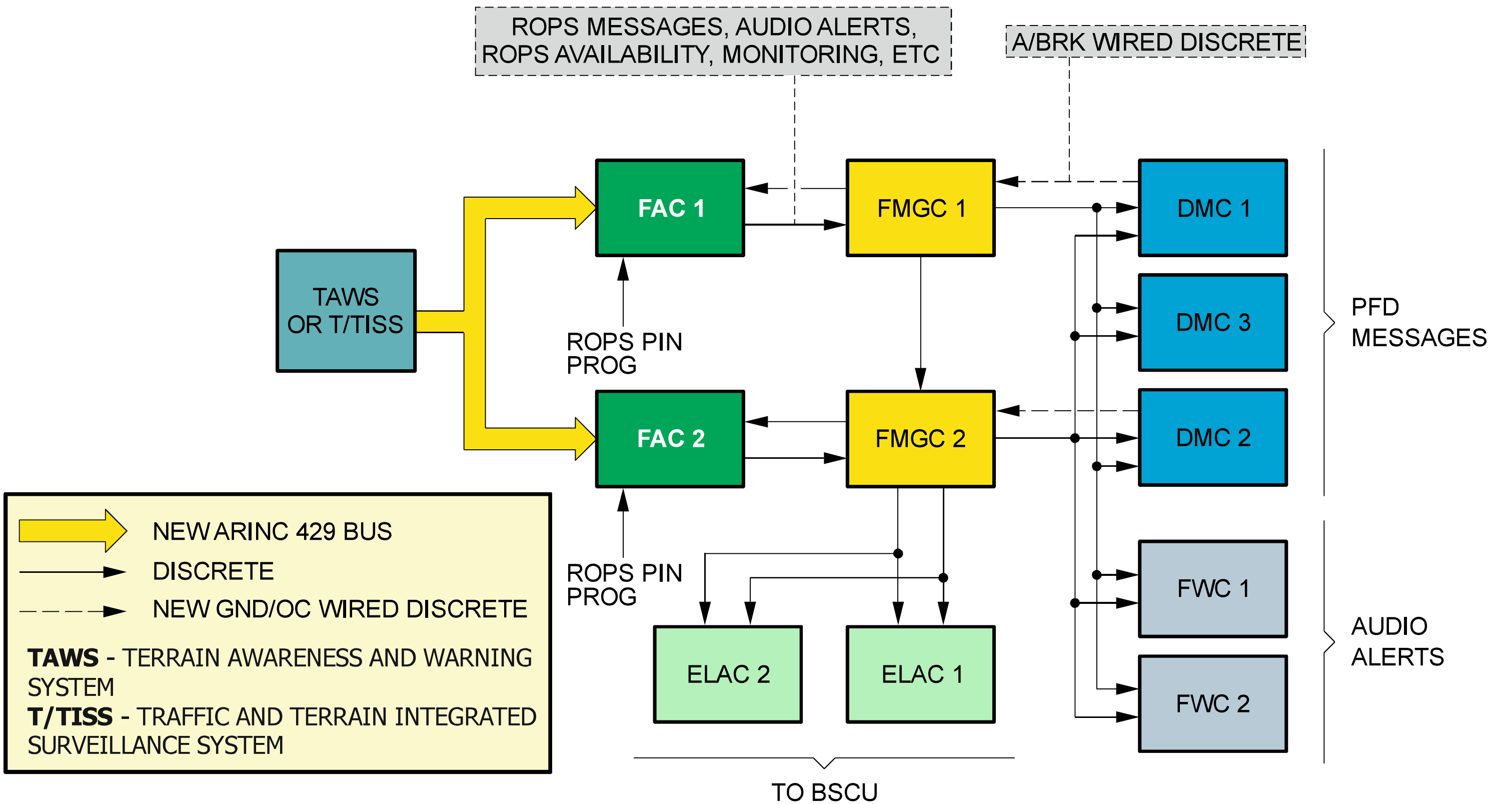
The FAC computes the minimal landing distances on DRY and WET runways, detects the risk of runway overrun and sends ROW alert requests. It computes a current estimation of the distance-to-stop, detects the risk of runway overrun and sends ROP alert requests, and monitors the availability of ROPS function.

The ROPS is a function hosted in the FAC (Flight Augmentation Computers) and is activated by FAC pin programming. It is not specific to the NEO aircraft and can be retrofitted to the CEO fleet.

Runway Information Output capability

Traffic and Terrain Integrated Surveillance System (T/TISS) or Terrain Awareness and Warning System (TAWS) (depending on option fitted) provides additional data to the ROPS system within the FAC (including a runway detection algorithm whose purpose is to select the approached runway and to output the associated runway information (runway length, heading and slope, A/C position relative to this selected runway) to the FAC.

ROPS OPERATION



ROW/ROP Warnings, ROP Messages
IF WET: RWY TOO SHORT

In flight, during approach, the amber IF WET: RWY TOO SHORT message comes into view when the FMGC predicts that a runway overrun will occur if the runway is wet. If the runway is dry, the message can be disregarded and the approach continued.

RWY TOO SHORT

In flight, during approach, the red RWY TOO SHORT message comes into view if the FMGC predicts that a runway overrun will occur. In this case, the pilot must follow the safe trajectory by using the TAKE OFF or GO AROUND mode.

MAX BRAKING

On the ground, the red MAX BRAKING message comes into view if the FMGC measures that the current braking deceleration does not allow to stop before the runway end. In this case, the pilot must apply full braking power.

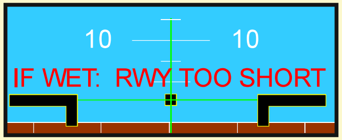
MAX REVERSE

On the ground, the red MAX REVERSE message comes into view if the FMGC measures that the current braking deceleration does not allow stopping before the runway end and no failure is detected on reverser by the FWC. In this case, the pilot must put the levers on reverse. Both MAX BRAKING and MAX REVERSE can be displayed at the same time

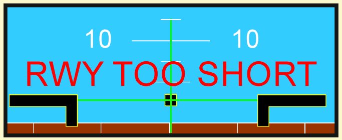
RWY AHEAD

Message On ground, a yellow pulsing RWY AHEAD message is displayed in PFD center in case of runway proximity detected by the OANS

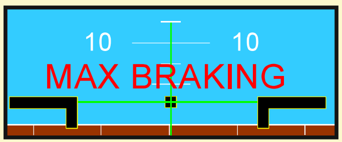
ROPS – PFD MESSAGES



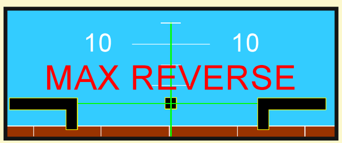
IN FLIGHT: THE FMGC PREDICTS THAT A RUNWAY OVERRUN WILL OCCUR IF THE RUNWAY IS WET. IF THE RUNWAY IS DRY, THE MESSAGE CAN BE DISREGARDED AND THE APPROACH CONTINUED.



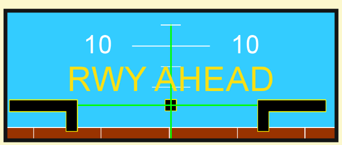
IN FLIGHT: IF THE FMGC CALCULATES THAT A RUNWAY OVERRUN WILL OCCUR. THE PILOT MUST FOLLOW THE SAFE TRAJECTORY BY USING THE TAKE OFF OR GO AROUND MODE.



ON THE GROUND: IF THE FMGC MEASURES THAT THE CURRENT BRAKING DECELERATION DOES NOT ALLOW TO STOP BEFORE THE RUNWAY END.
IN THIS CASE, THE PILOT MUST APPLY FULL BRAKING POWER.
NOTE: BOTH MAX BRAKING AND MAX REVERSE MESSAGES CAN BE DISPLAYED AT THE SAME TIME.



ON THE GROUND: FMGC CALCULATES THAT THE CURRENT BRAKING DECELERATION WILL NOT STOP A/C BEFORE RUNWAY'S END (NO FAILURE DETECTED OF REVERSER BY FWC) AND THE PILOT MUST SELECT REVERSE.
NOTE: BOTH MAX BRAKING AND MAX REVERSE MESSAGES CAN BE DISPLAYED AT THE SAME TIME.



ON THE GROUND (PULSING): IF OANS (ONBOARD AIRPORT NAVIGATION SYSTEM) (OPTION) DETECTS THAT THE AIRCRAFT IS IN PROXIMITY TO AN ACTIVE RUNWAY.

Traffic and Terrain Integrated Surveillance System (T/TISS) – (Option)

General

The Traffic and Terrain Integrated Surveillance System (T/TISS) is a combination of three functions in a single Line Replaceable Unit (LRU).

These functions are:

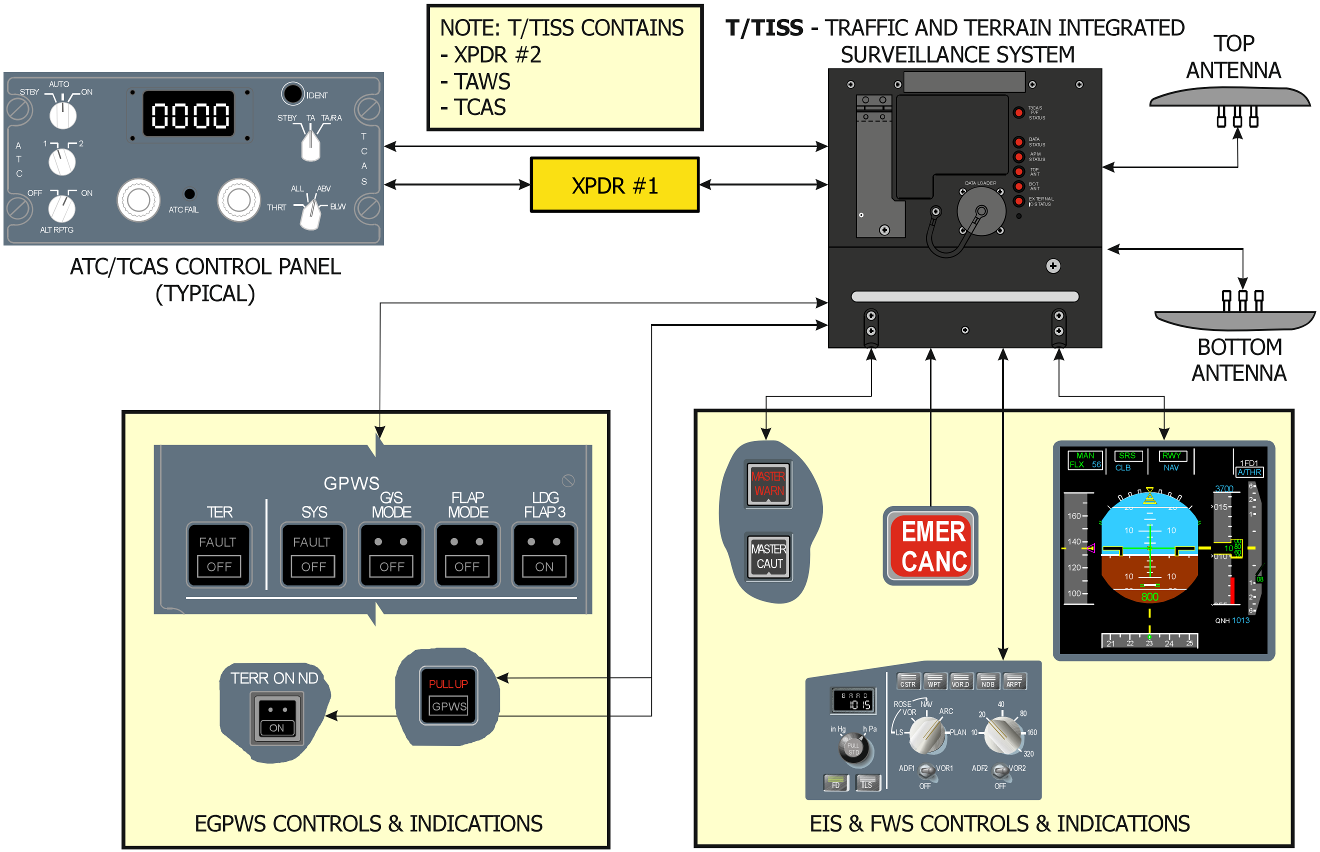
- Traffic alert and Collision Avoidance System (TCAS) (TCAS II Change 7.1) with Airborne Traffic Situation Awareness (ATSAW) capability
- Terrain Awareness and Warning System (TAWS)
- ATC/Mode S transponder (compliant with DO-260B and DO-181E)

The TISS replaces the need for separate ATC, TCAS and EGPWS LRUs and expands the functionality of the current systems.

The operation and visual indications to the flight crew are the same as for the conventionally separate systems listed above. Only the aural messages are different.

Note: The T/TISS may also be installed as a SB under modification on the CEO & NEO fleets.

Traffic and Terrain Integrated Surveillance System (T/TISS) – (Option)



Traffic and Terrain Integrated Surveillance System (T/TISS) - Unit

The unit is located on the 82VU.

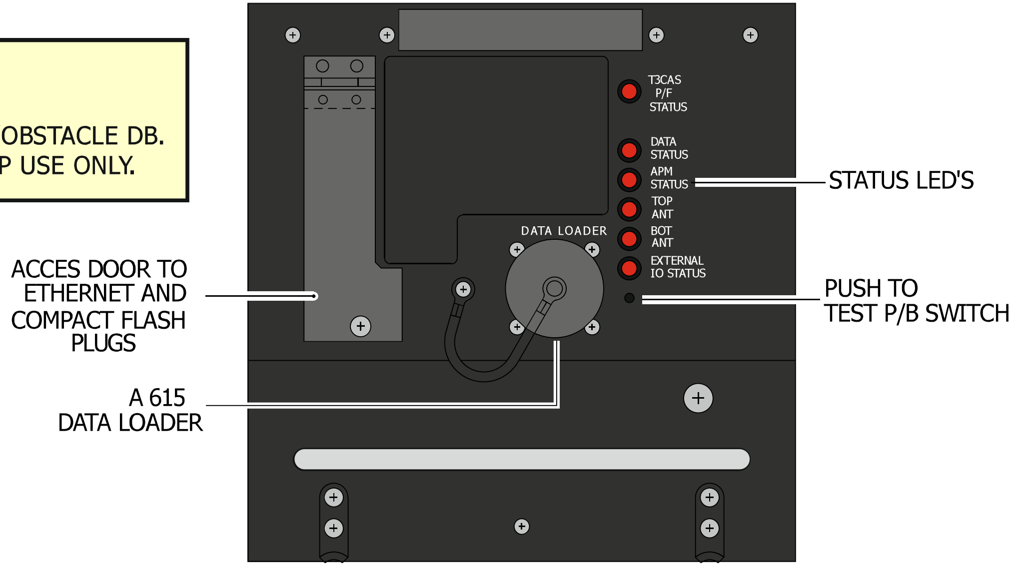
It is data loaded differently, dependent on the function being updated:

- An ARINC 615A data loader connector allows updating the T/TISS software (for the TCAS part)
- A Compact Flash data loader/recorder connector provides the same function for the TAWS part and can be used to update the TAWS database (Terrain database and separate obstacle database)

An Ethernet plug is used for maintenance tasks (shop only).

TRAFFIC AND TERRAIN INTEGRATED SURVEILLANCE SYSTEM (T/TISS) - UNIT

NOTE:
- A615 PORT IS FOR TCAS S/W.
- COMPACT FLASH CARD IS FOR TAWS/OBSTACLE DB.
- ETHERNET CONNECTION IS FOR SHOP USE ONLY.



T/TISS - TRAFFIC AND TERRAIN INTEGRATED SURVEILLANCE SYSTEM

Back up Speed Scale (BUSS) - Option

In the event of total air data failure, the crew may select the BKUP SPD/ALT pushbutton switch.

On the PFD, the back-up speed and altitude scales replace the speed and altitude indications displayed on the Primary Flight Display (PFD).

Barometric altitude

The barometric altitude is replaced by the Global Positioning System (GPS) altitude:

- The GPS ALT indication appears under altitude scale
- The GPS indication is displayed near the GPS altitude. Since the GPS altitude is less accurate than the barometric altitude, the last two insignificant digits are dashed.

Airspeed Indication

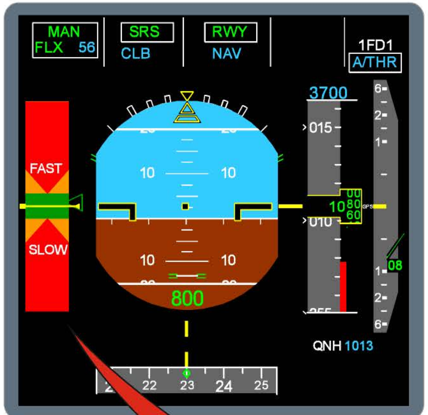
The CAS usually displayed on the PFD is replaced by the median value of the three AOA values coming from the ADRs via the Internal Reference (IR) bus.

The Back-Up Speed Scale (BUSS) is not graduated like the normal airspeed indication but is divided into five coloured areas (one green area, two amber arrows and two red areas) which are more easily usable and understandable by the pilots.

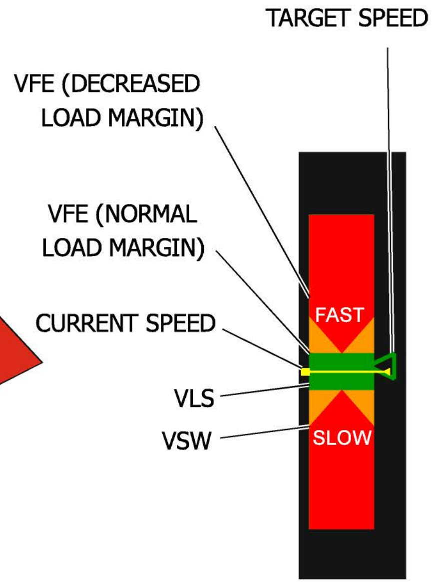
An AOA which is too low means an airspeed that is too fast and the opposite is true too. Moreover, a bug represented by a green arrow indicates the speed to be reached for the pilot.

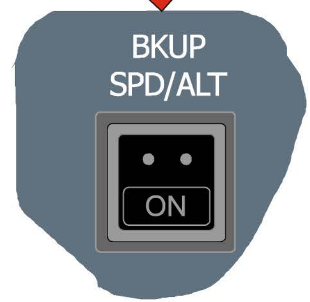
Note: The BUSS may also be installed as a SB under modification on the CEO & NEO fleets.

BACK UP SPEED SCALE (BUSS)



PFD





A319/A320 FUEL SYSTEM DESCRIPTION & OPERATION (LEAP-1A & PW1100G)

Level 3

INTRODUCTION

The new A319/A320 Fuel System is a combination of the common Wing Structure of the SA Aircrafts manufactured (A318/A319/320) and the Fuel System Components installed in A321 since entry into service and will be the manufacturing standard with the beginning of delivery of all NEO Single Aisle Aircrafts, except the A318.

The benefit to combine both layouts, on the new A319/A320 Fuel System, is to achieve the following:

- Weight reduction,
- Better protection against UERF (Uncontained Engine Rotor Failure),
- Cost improvements,
- Communality in between all SA Aircraft variants.

Two fuel pumps are installed in each wing tank. One fuel pump is installed for the APU. Fuel is supplied to the engines from the wing tanks only. As the fuel level in the wing decreases, the centre tank fuel is transferred to the wing tanks until the centre tank is empty. Fuel transfer from the centre tank to the wing tanks is controlled by transfer valves. When the transfer valves are opened, they supply pressure to two jet pumps in the centre tank and transfer the fuel from the centre tank to the wings.

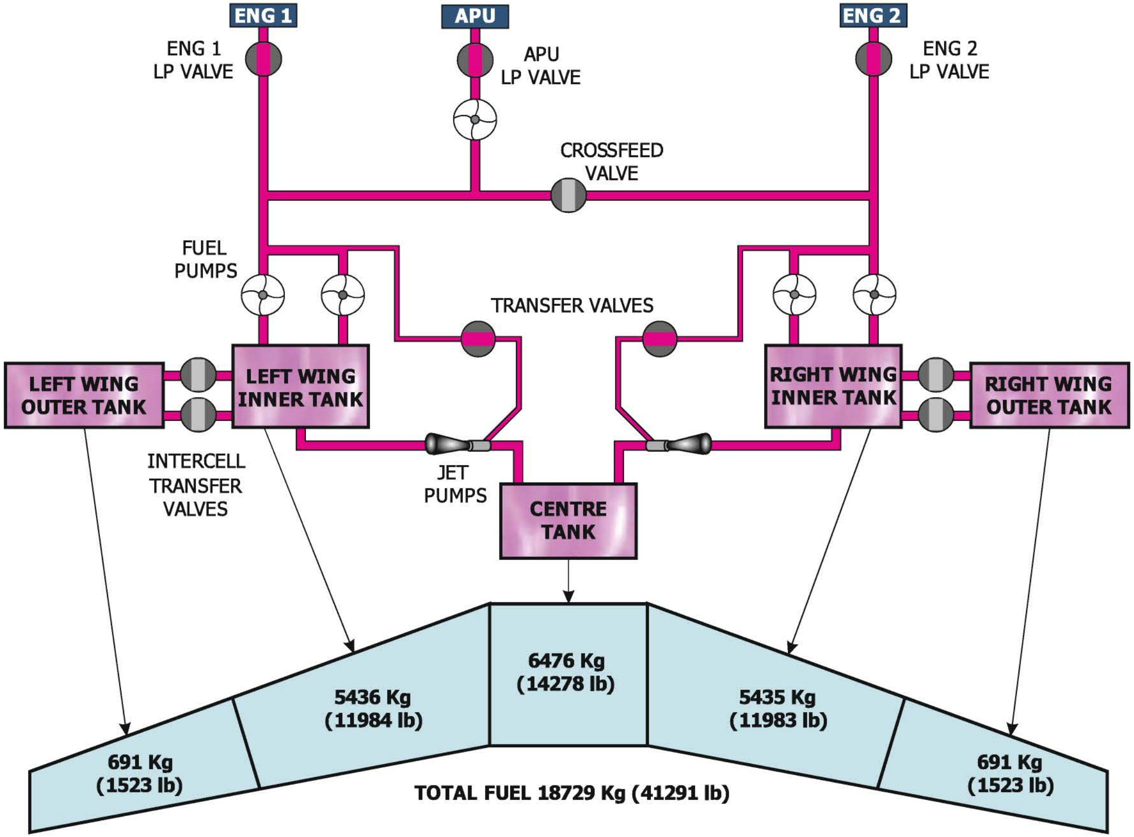
Two engine LP valves are installed to supply or cut off fuel to the engines. The LP valve is closed when the related engine is shut down or when the engine fire pushbutton is released.

A crossfeed valve is installed to connect or isolate the left and right hand sides. It enables engine to be fed from any available fuel pump. On the ground, the crossfeed valve enables fuel to be transferred from tank to tank. The valve is closed for normal operation.

The fuel system also feeds the APU directly from the left hand side. The APU LP valve is installed to supply or cut off fuel to the APU. It closes when the APU is shut down or when the APU FIRE pushbutton is released out.

Note: This change to the A319/320 system is not specific to the NEO and has been introduced on the production line for the latter CEO aircraft. The A321 NEO remains the same. The A318 fuel system has not been changed.

A319/A320 FUEL SYSTEM (CENTRE JET PUMPS)



FUEL CONTROL AND INDICATING - Level 3

This section will highlight the control panels and indications for the fuel system.

CONTROL PANELS

The FUEL control panel is operated from the overhead panel.

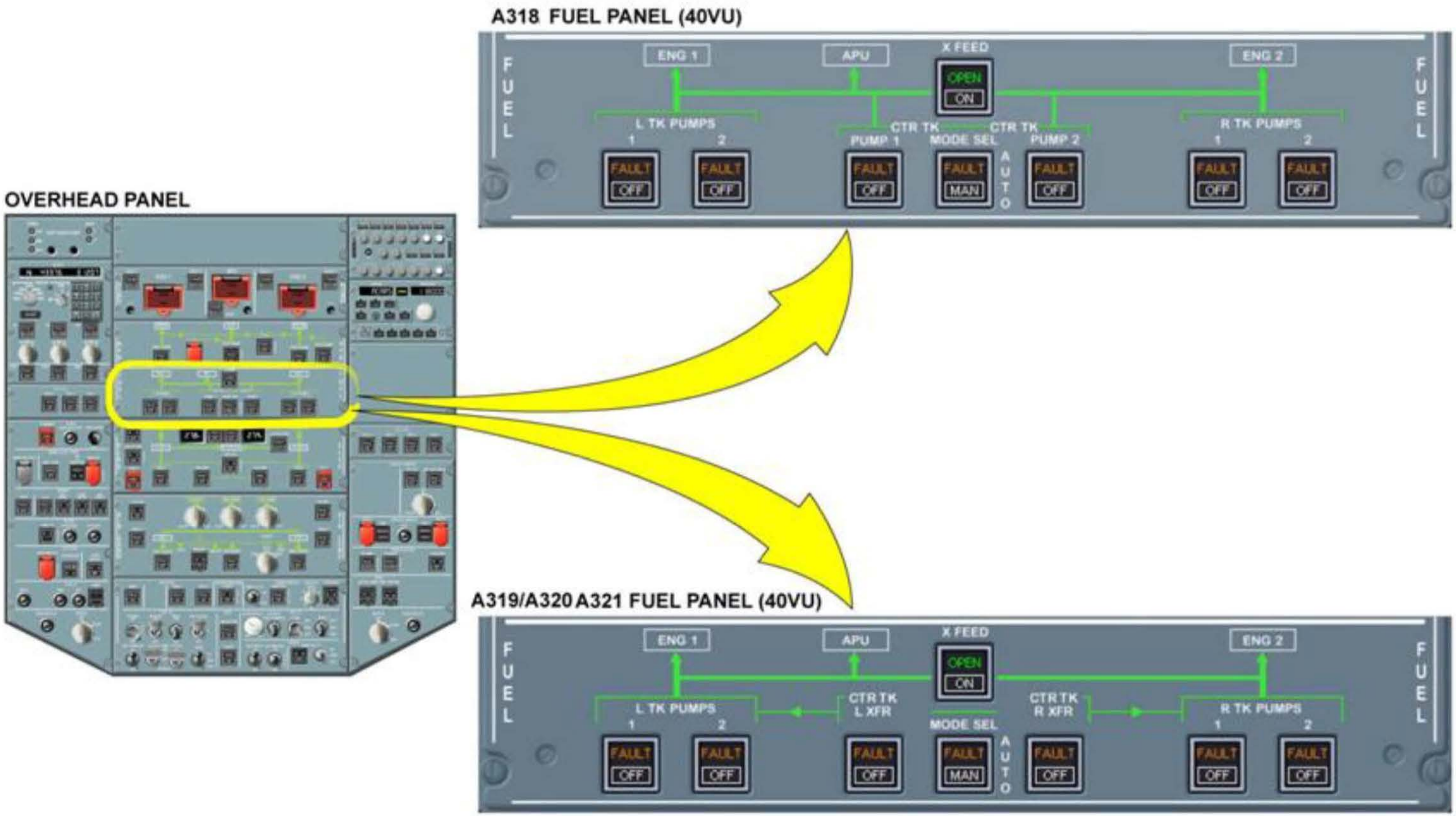
The A319/A320/A321 FUEL control panel is very similar to the A318, except:

- The fuel transfer link between the centre and wing tanks is indicated,
- CTR TK XFR is indicated instead of CTR TK PUMPS.

The wing tank pumps are controlled manually but the centre tank pumps are normally controlled automatically. On theA318 fuel control panel, the MODE SEL P/BSW enables the pilot to select automatic or manual mode for the centre tank pumps.

The MODE SEL P/BSW on the A319/A320/A321FUEL control panel enables the pilot to select manual or automatic mode for the CTR TK XFR valves.

FUEL CONTROL PANELS



ECAM FUEL PAGE

The configuration of the fuel system valves and pumps (as well as quantity indications) is displayed on the ECAM FUEL system page. The total Fuel On Board (FOB) indication is duplicated on the Engine/Warning Display.

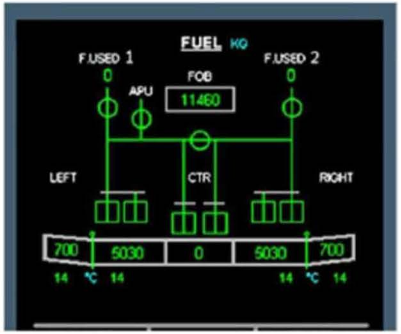
Let's briefly review all the A321 differences using the ECAM FUEL page:

- There is no inner and outer cells in the wing tanks,
- Fuel is transferred from the centre tank to the wing tanks via two jet pumps and transfer valves,
- Fuel is always fed to the engines from the wing and not from the centre tank.

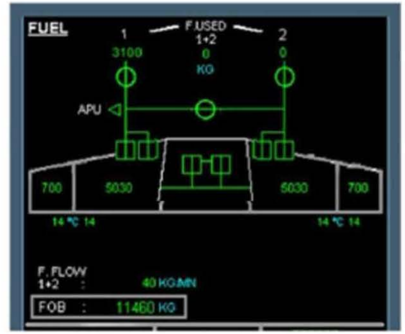
For the actual A319/A320 configuration there is a combination of the A318 and the A321 Fuel System:

- Still separated into inner and outer cells for the wing tank
- Fuel is transferred from the centre tank to the wing tanks via two jet pumps and transfer valves,
- Fuel is always fed to the engines from the wing and not from the centre tank.

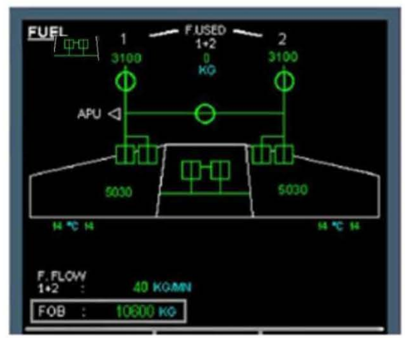
ECAM FUEL PAGES



A319 FUEL PAGE



A319/A320 FUEL PAGE (ENHANCED)



A321 FUEL PAGE (ENHANCED)

CREW OXYGEN SYSTEM DESCRIPTION & OPERATION NEO - Level 3

Introduction

The crew system comprises two separate systems.

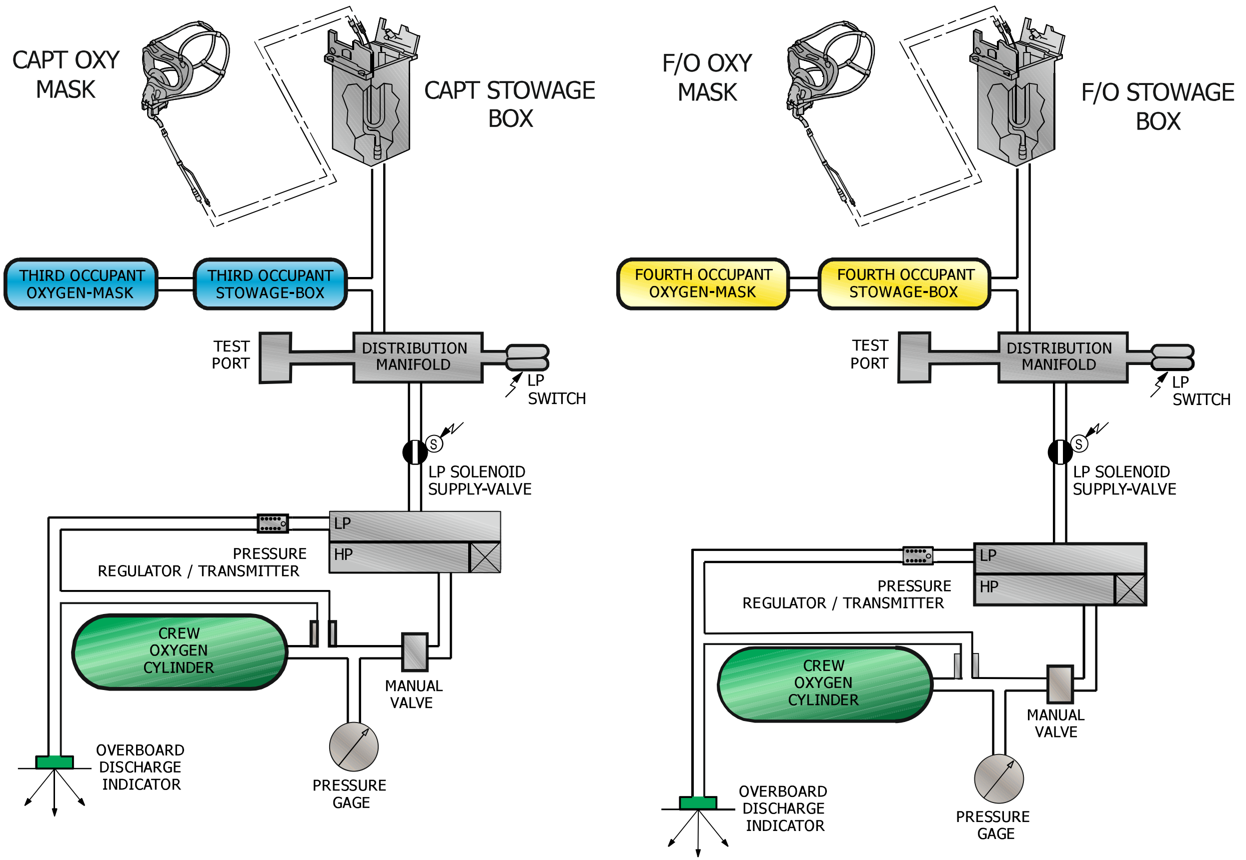
Two High Pressure (HP) oxygen cylinders supply oxygen to the flight crew.

The first (Captain's) HP oxygen cylinder is installed between frames 11 and 12 in the left part of the avionics compartment.

The second (First Officer's) HP oxygen cylinder is installed between frames 16 and 17 in the left part of the avionics compartment.

The head of each HP oxygen cylinder has a direct connection to a pressure regulator/transmitter. These pressure regulators/transmitters supply LP oxygen to the distribution circuit. Each system includes an overboard discharge system for safety (green disc), if an overpressure occurs in the HP and/or in the LP oxygen lines of the system.

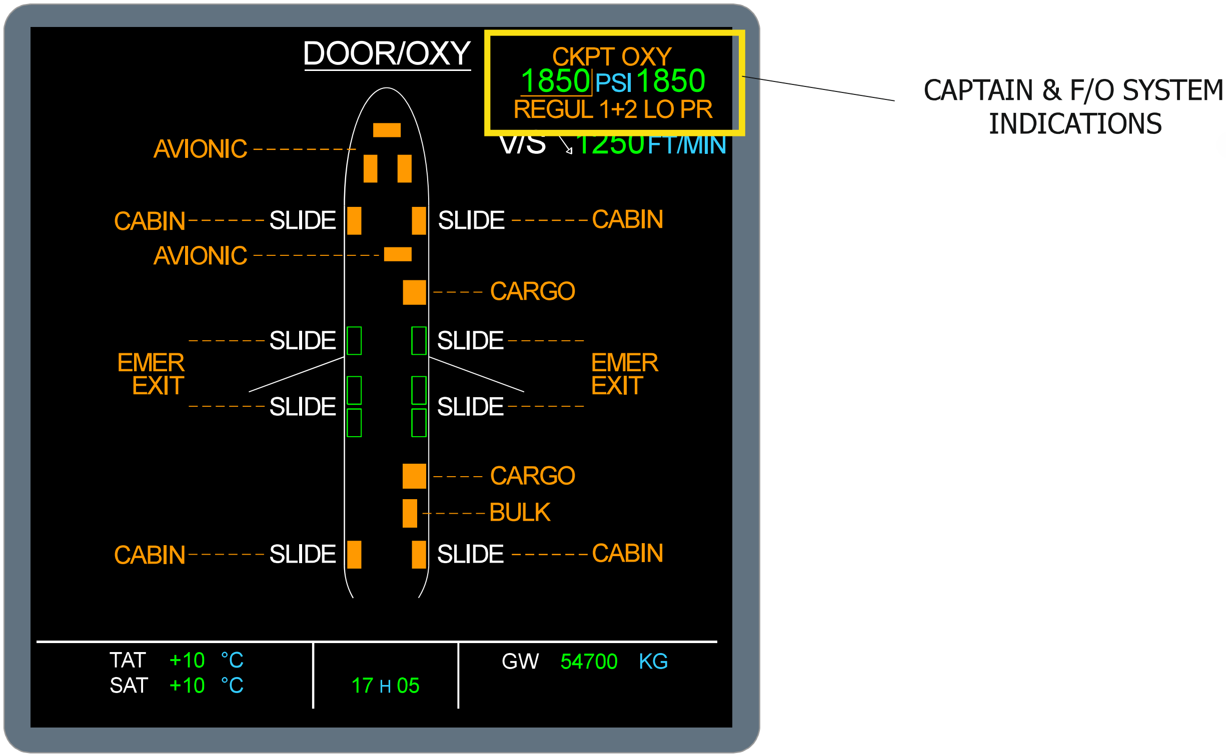
CREW SYSTEM


CAPT OXY MASK
CAPT STOWAGE BOX
THIRD OCCUPANT OXYGEN-MASK
THIRD OCCUPANT STOWAGE-BOX
TEST PORT
DISTRIBUTION MANIFOLD
LP SWITCH
LP SOLENOID SUPPLY-VALVE
LP
HP
PRESSURE REGULATOR / TRANSMITTER
CREW OXYGEN CYLINDER
MANUAL VALVE
OVERBOARD DISCHARGE INDICATOR
PRESSURE GAGE
F/O OXY MASK
F/O STOWAGE BOX
FOURTH OCCUPANT OXYGEN-MASK
FOURTH OCCUPANT STOWAGE-BOX
TEST PORT
DISTRIBUTION MANIFOLD
LP SWITCH
LP SOLENOID SUPPLY-VALVE
LP
HP
PRESSURE REGULATOR / TRANSMITTER
CREW OXYGEN CYLINDER
MANUAL VALVE
OVERBOARD DISCHARGE INDICATOR
PRESSURE GAGE

Indications

The indicating system controls and monitors the crew oxygen system. The DOOR/OXY page on the ECAM DU displays two pressures, one for the Captain's oxygen cylinder, and the second for the First Officer's oxygen cylinder. In the cockpit, on the OXYGEN section of the overhead control and indicating panel 21VU, there is one CREW SUPPLY pushbutton switch that activates the two LP solenoid supply-valves in each sub-system.

OXYGEN INDICATIONS



SD

Component Locations

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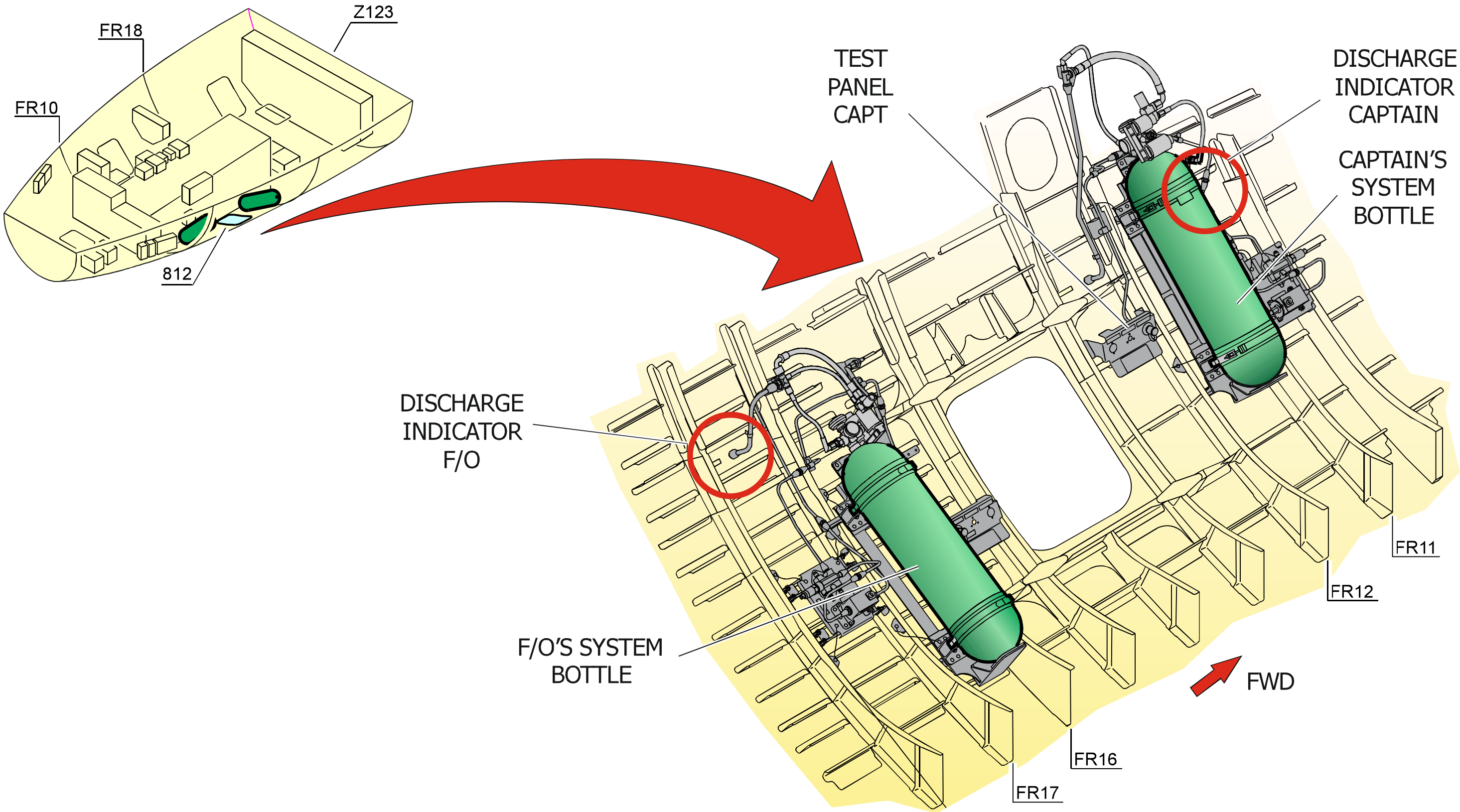
COMPONENT LOCATIONS



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CFM LEAP-1A – DIFFERENCES

ELECTRICAL POWER GENERATION SYSTEM LEAP-1A - Level 3

GENERAL

Each engine has am Integrated Drive Generator (IDG). The IDG converts the variable-speed shaft power directly into constant frequency 400 Hz AC electrical power. The Constant Speed Drive (CSD), in the IDG, drives the AC generator at constant speed. Thus, the AC generator produces constant frequency power.

Note: The electrical distribution system is identical to the CEO Enhanced aircraft fleet.

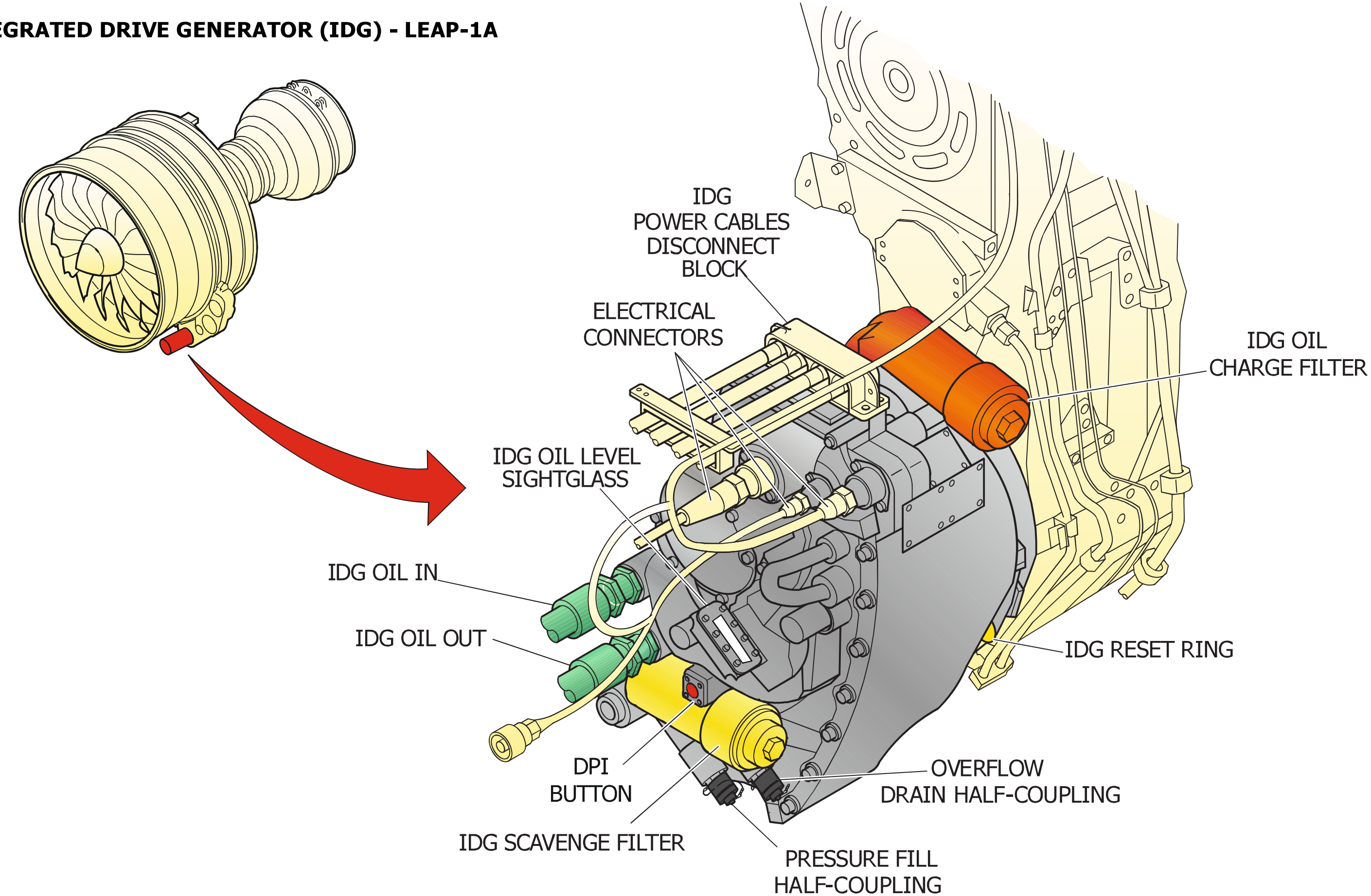
INTEGRATED DRIVE GENERATOR (IDG)

The IDG has an automatic and a manual thermal disconnect-mechanism. The manual disconnect mechanism has a solenoid, a spring-loaded disconnect plunger, a cam shaft and a reset ring. The crew pushes the IDG pushbutton switch when the IDG FAULT legend comes on. When activated, the IDG cannot be reconnected in flight.

It is reset via the IDG pull ring on the ground with the engine stationary.

At an IDG oil temperature of 199 deg.C (390.2 deg.F), an automatic thermal disconnect-mechanism disconnects the IDG. When this occurs, the IDG must be changed.

INTEGRATED DRIVE GENERATOR (IDG) - LEAP-1A



Filters and Servicing

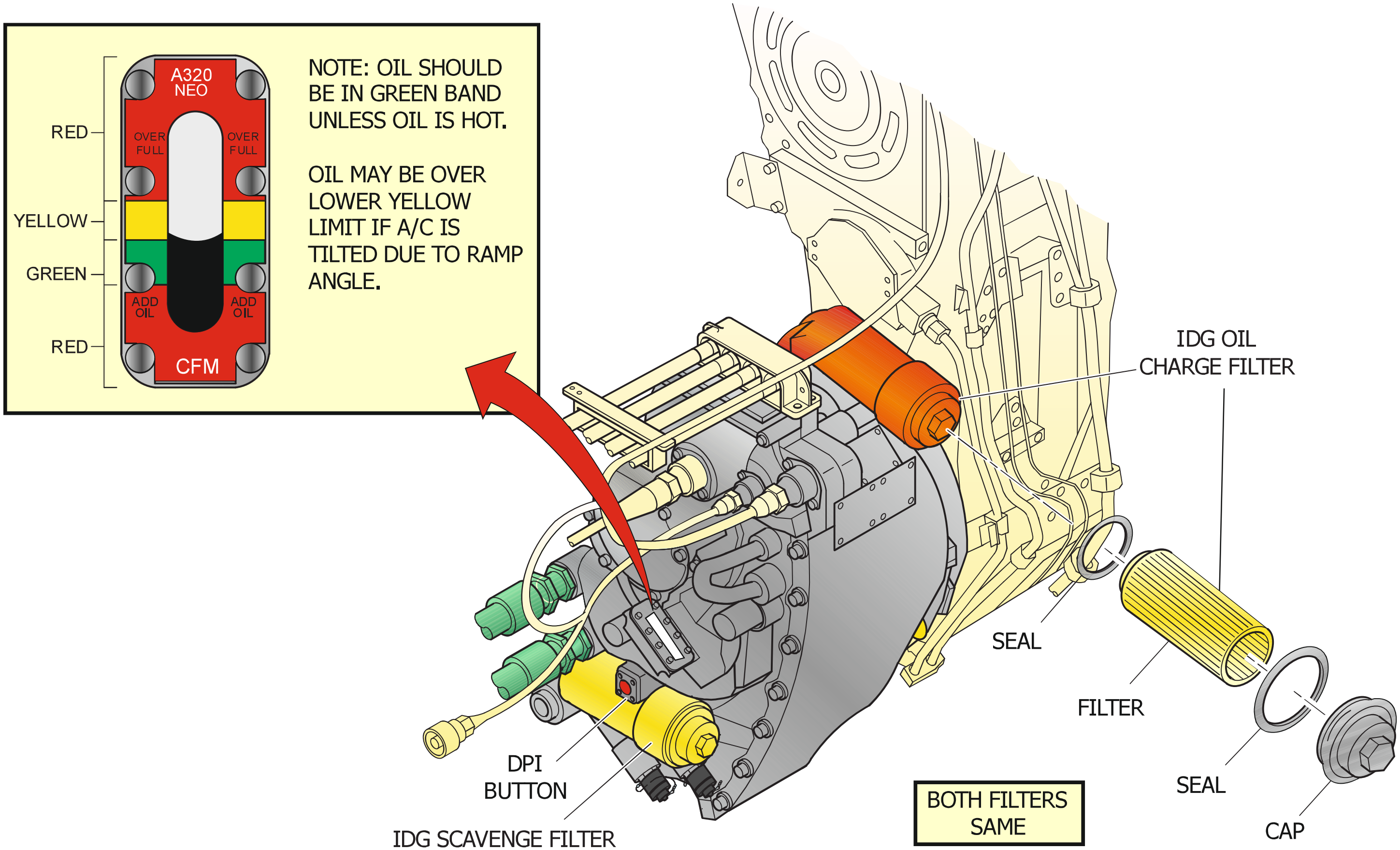
The IDG has standard connections for filling/draining and a sight glass indicating IDG oil level.

The IDG has scavenge and charge filters .The scavenge filter has a DPI 'pop-out' indication when in bypass.

The sightglass has warning indications for underfull and overfull and a caution indication for approaching overfill.

Note: The oil should be in the green band. It may be in the yellow band if the IDG oil is hot after shutdown or just above the lower limit (if the aircraft is not level). Consult AMM 12-13-24.

INTEGRATED DRIVE GENERATOR (IDG) - LEAP-1A



OIL COOLER - LEAP-1A

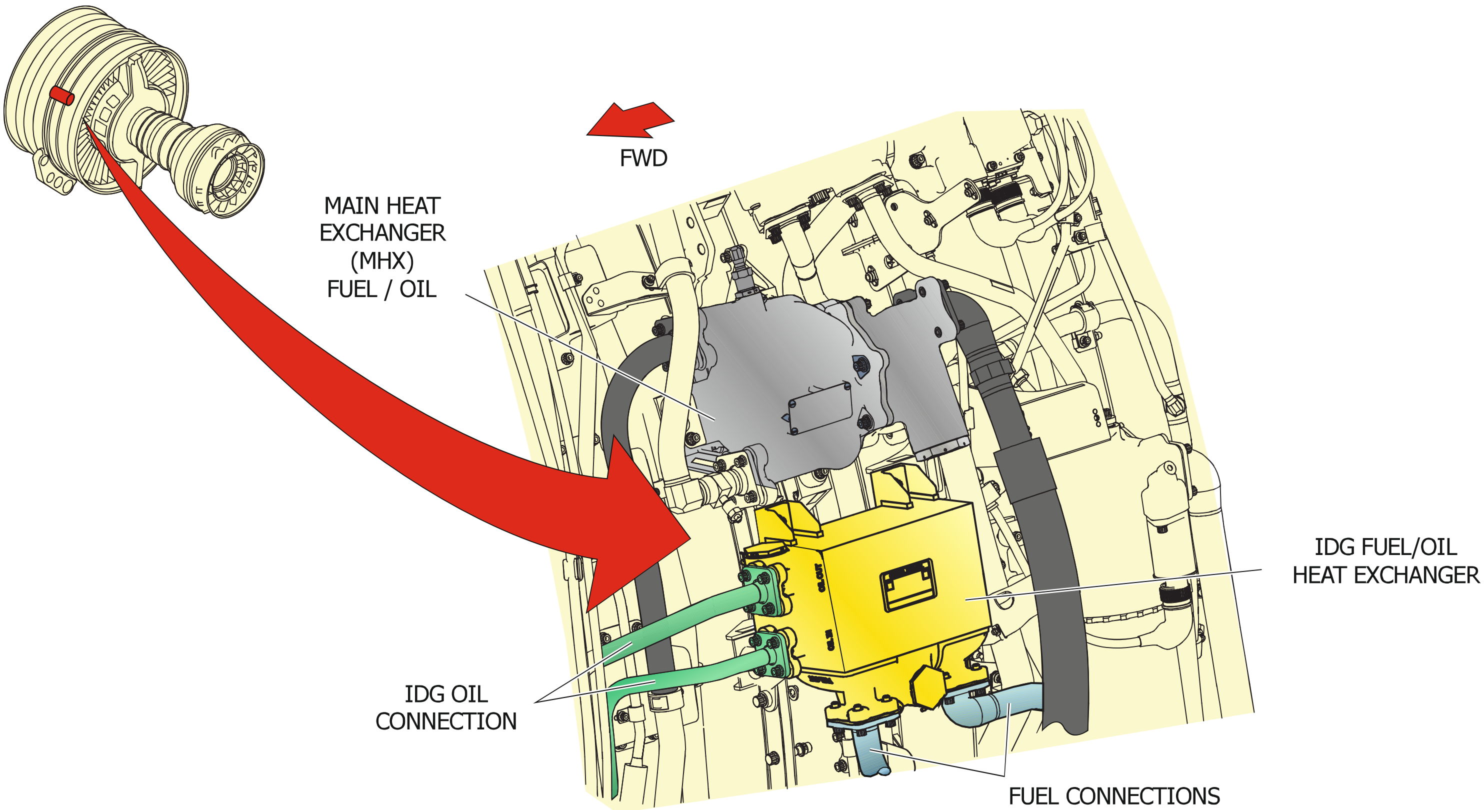
The IDG oil cooler is used to control the IDG oil temperature.

The IDG oil cooler provides thermal exchange between hot IDG oil and cold fuel.

It is located on the L/H fancase at the 2 o'clock position.

Note: The IDG oil cooler is also refered to as the Fuel/Oil Heat Exchanger.

IDG OIL COOLER - LEAP-1A



FIRE PROTECTION SYSTEM COMPONENT LOCATION LEAP-1A - Level 3

SYSTEM OVERVIEW

The engine fire protection is performed by two sub-systems:

- FIRE detection system
- FIRE extinguishing system

ENGINE FIRE PROTECTION

The engines have individual fire detection systems. Each system has two identical detection loops (A and B) installed in parallel. Each loop includes 3 detector elements.

These detection elements are located around the Accessory Gear Box (AGB), core engine area and pylon area.

The two loops are monitored by a Fire Detection Unit (FDU). FDU 1 monitors the loops on engine 1 and FDU 2 monitors the loops on engine 2.

The FDU sends FIRE and FAULT signals to the Flight Warning Computer (FWC) for display on ECAM.

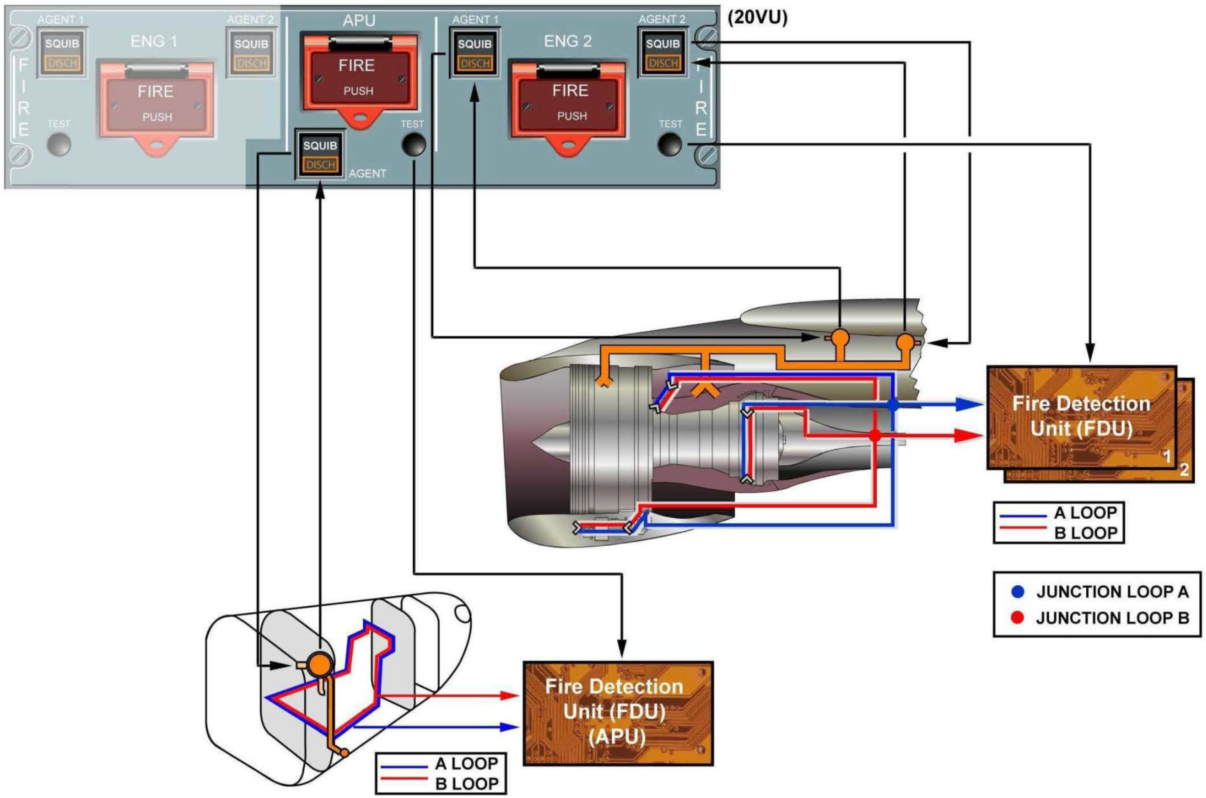
Each engine has 2 fire bottles installed in the pylon.

The discharge of each bottle is controlled by a related AGENT P/BSW on the FIRE panel.

The TEST buttons are used to do tests on the different fire detection and extinguishing systems and make sure they operate correctly.

- The CFM LEAP-1A has 4 detectors (pylon, fan, AGB and core)

SYSTEM OVERVIEW - ENGINE AND APU FIRE DETECTION & ENGINE AND APU FIRE EXTINGUISHING (PRINCIPLE CEO & NEO)



FIRE DETECTION LOOPS - LEAP-1A

Fire Detectors

Each fire and overheat detector has a sensing element and responder assembly.

The fire detection loop has four fire detectors connected in parallel. They are installed in:

- Accessory gearbox.
- Around the turbine stages of the engine.
- Around the ventilation exit of the fan compartment.
- And on the pylon above the combustion chamber.

Sensing element

A sensing element is a tube with an outer diameter of 0.063 in. (1.6 mm).

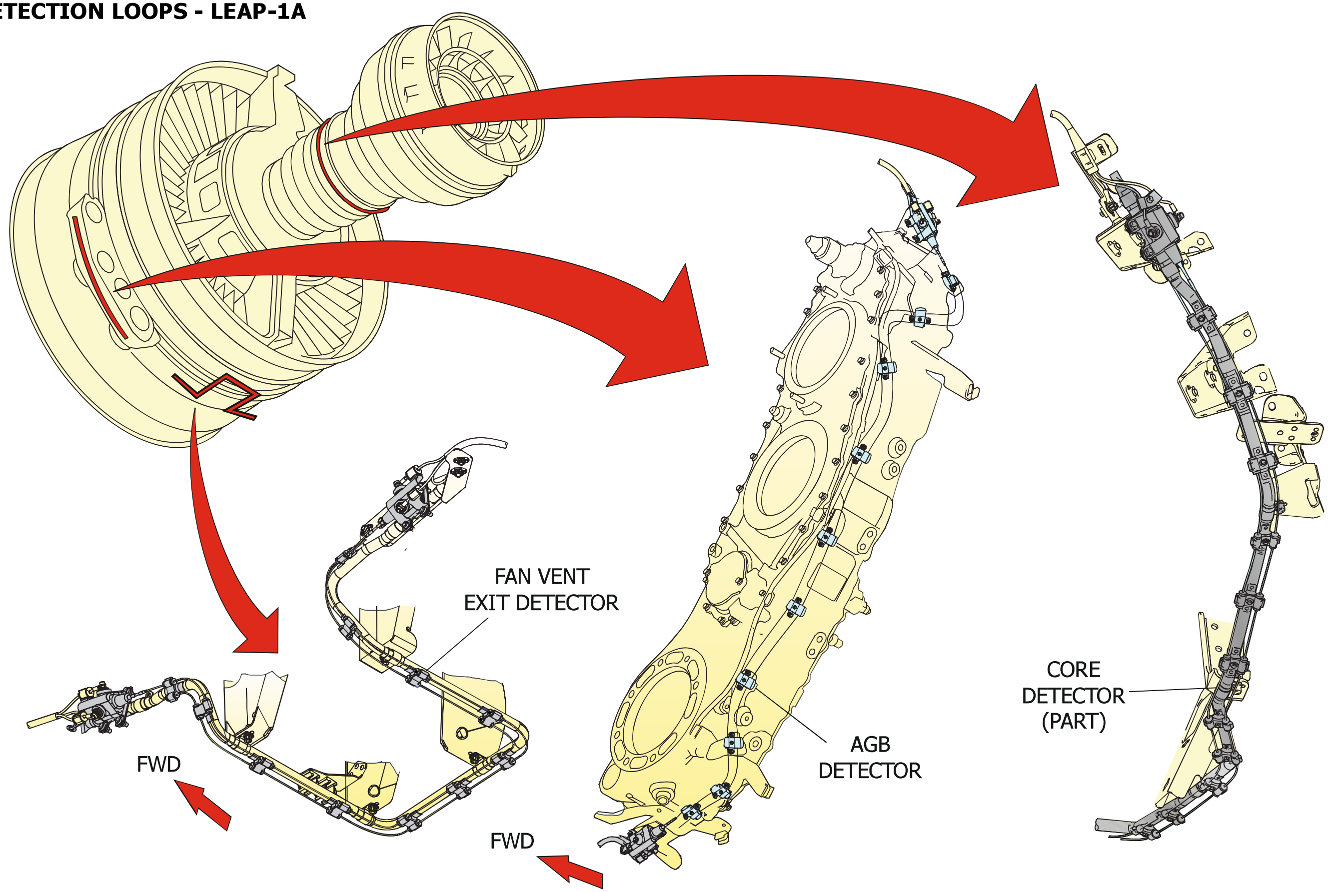
It has a hydrogen-charged titanium core with a spiral wound around it. This spiral is made of an inert material which has a special property: it can release and absorb a gas. The space between the sensing-element outer-tube wall and the core is filled with helium. The initial pressure of the helium is related to the pre-set temperature limit selected for each sensing element. The sensing element reacts according to the ideal gas law. One end of the sensing element is hermetically soldered and the other one is connected to a 1 in. (25.4 mm) diameter stainless steel body referred to as the responder.

Responder assembly

The responder has a chamber connected to two pressure switches: an ALARM switch and a MONITOR switch. The free end of the responder is connected to the aircraft electrical circuit. The detector has two sensing functions. It senses an overall "average" temperature and a highly-localized "discrete" temperature caused by an impinging flame or hot gases. As a result, the ALARM switch closes. It is not possible to adjust the "average" and "discrete" temperatures. The averaging and discrete functions are reversible. When the sensor tube is cooled, the average gas pressure decreases and the core material absorbs the discrete hydrogen gas. If there is a leak on the detector, the gas pressure decreases, which causes the MONITOR switch to open and sends a detector fault signal. Then, the system does not operate during the test.

NOTE: The fire detector sensors must be installed before the rail assembly is attached to the mounting brackets.

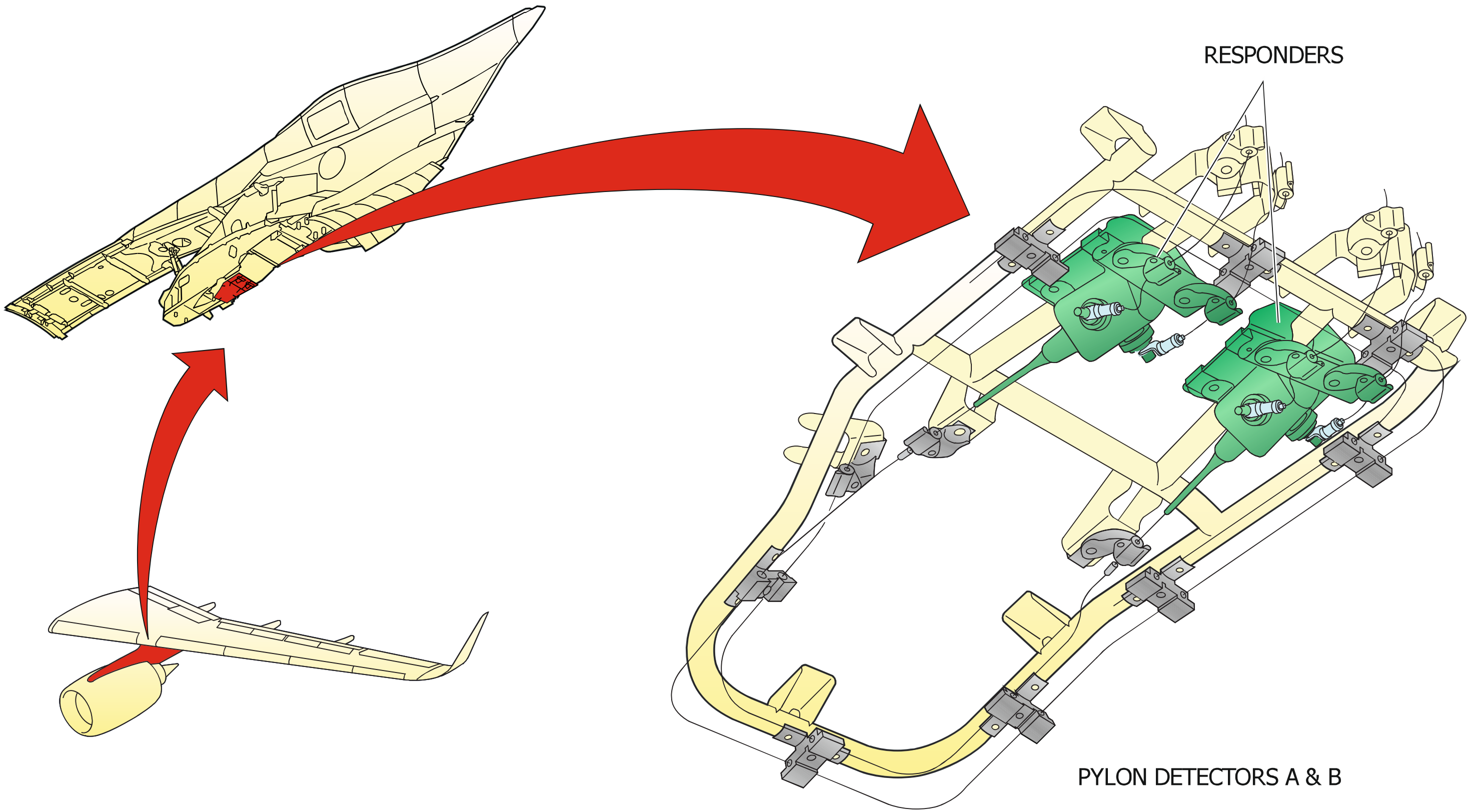
FIRE DETECTION LOOPS - LEAP-1A



Pylon Detector

The pylon detector is attached to the underside of the pylon above the combustion chamber.

PYLON DETECTORS – LEAP-1A



FUEL RETURN TO TANK SYSTEM LEAP-1A - Level 3

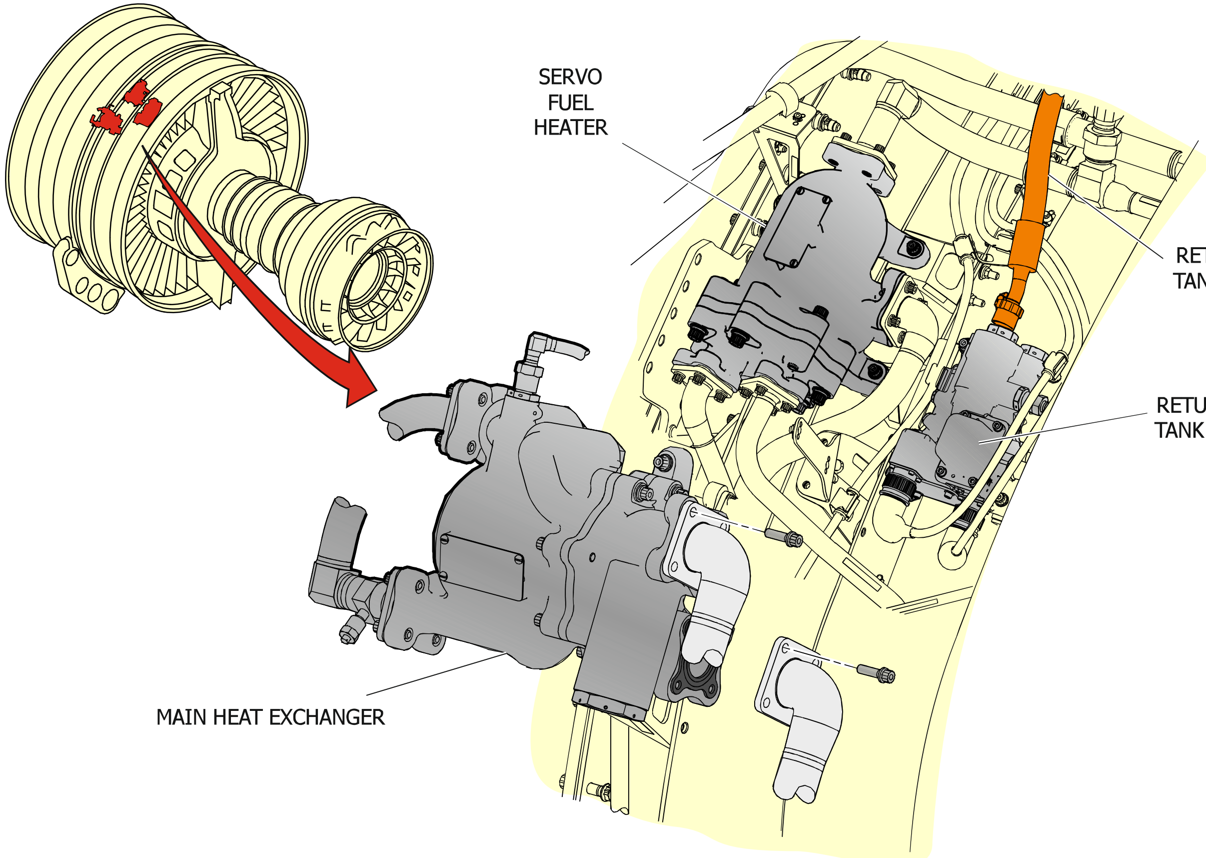
GENERAL

Note: The operation is the same for PW1100G and LEAP-1A NEO types.

The temperature of the Integrated Drive Generator (IDG) oil is decreased by fuel through a recirculation system. Some of the fuel that supplies the engines is used to decrease the temperature of the IDG oil. A Fuel Return To Tank valve (FRTT) lets the hot fuel return to the outer cell. The FRTT opens the fuel flow back to the aircraft tank in special engine configurations (N2, fuel flow...). The return valve mixes the hot fuel with cold fuel from the Low Pressure (LP) fuel pump to keep the temperature of the returned fuel less than 100°C (212°F). The Fuel Level Sensing Control Unit (FLSCU) 1 and the Engine Electronic Control (EEC) 1 control the recirculation system in the left wing. FLSCU 2 and EEC 2 control the right wing system.

This system works in the same manner to CEO aircraft except for the location of the Fuel Return To Tank valve (FRTT), which is also referred to as the Fuel Return To Tank Module.

FUEL RETURN TO TANK VALVE LEAP-1A



HYDRAULIC SYSTEM PRESENTATION LEAP-1A - Level 3

ENGINE DRIVEN PUMP

A splined quill drive connects the gearbox to the input shaft of the pump. The quill drive is made to shear if the pump cannot turn. The attachment flange of the pump has keyhole slots where the installation bolts are. On the PW1100G, a heat shield is installed between the MGB and the EDP.

The suction line connection has a quick-release, self-sealing coupling. Together, they make it possible to replace the pump quickly. The pump is of the variable-displacement type. The rotating assembly turns all of the time that the engine operates. The pump has nine pistons which are connected to a moveable yoke plate. When the angle of the yoke plate changes, the stroke of the pistons changes and the output of the pump is increased or decreased. The compensator valve supplies servo pressure to the actuator piston, which controls the angle of the yoke.

A solenoid valve (controlled from the flight compartment) makes it possible to change the operation of the pump so that it does not supply pressure to the system (depressurized mode). The EDP includes a blocking valve which isolates the pump from the hydraulic system when the pump operates in the depressurized mode. In the depressurized mode the outlet of the pump is connected internally directly to the inlet of the pump. The pump then operates with an internal pressure of approximately 1000 psi (70 bar), with zero flow. This is the pressure necessary on the actuator piston to reduce the angle of the yoke to near zero when the outlet and control pressures are balanced.

A case pressure relief valve connects the fluid in the EDP case to the inlet of the pump if the pressure of the fluid in the case is too high (for example if the case drain pipe is blocked). A pump inlet boost impeller is included in the EDP which increases the pressure of the fluid at the inlet of the pump. This makes certain that the chambers of the pump get a sufficient supply of fluid at all conditions of operation. Seal drain fluid goes into a container, which is also used to collect oil from the accessory gearbox. The fluid from the two components is kept divided.

Thus it is possible to find if the leakage of fluid past the seals of the pump or gearbox is too high. The EDP supplies fluid at 206 + 3 -0 bar (3000 +43 -0 psi) at zero delivery and a flow of 150 l/min (39.6 US gal) at a speed of 3982 rpm (100% engine speed).

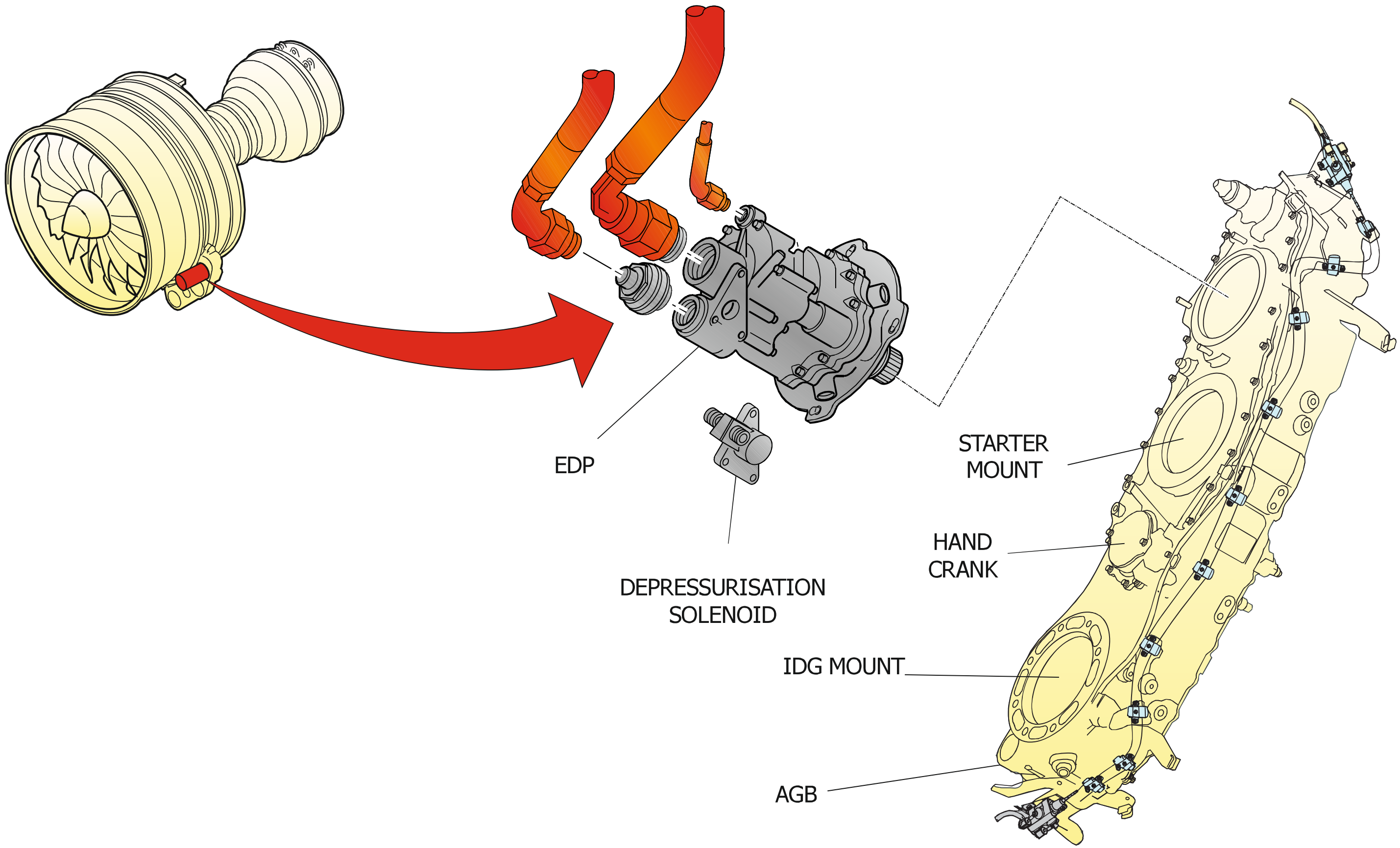
Location

- LEAP-1A, fan case 8 o'clock position - mounted horizontally.

PTU Inhibition (Not Illustrated)

The temperature inhibition for the PTU has increased to 100°C (from 95°C). Additionally the inhibition logic has changed slightly (inhibited if the aircraft is on the ground, the two engines are in operation and the air speed is low (<50kts).

ENGINE DRIVEN PUMP LEAP-1A



CASE DRAIN FILTER - LEAP-1A

The Case Drain Filter is located on the LHS of the fan case.

The Case Drain Filter has three main parts:

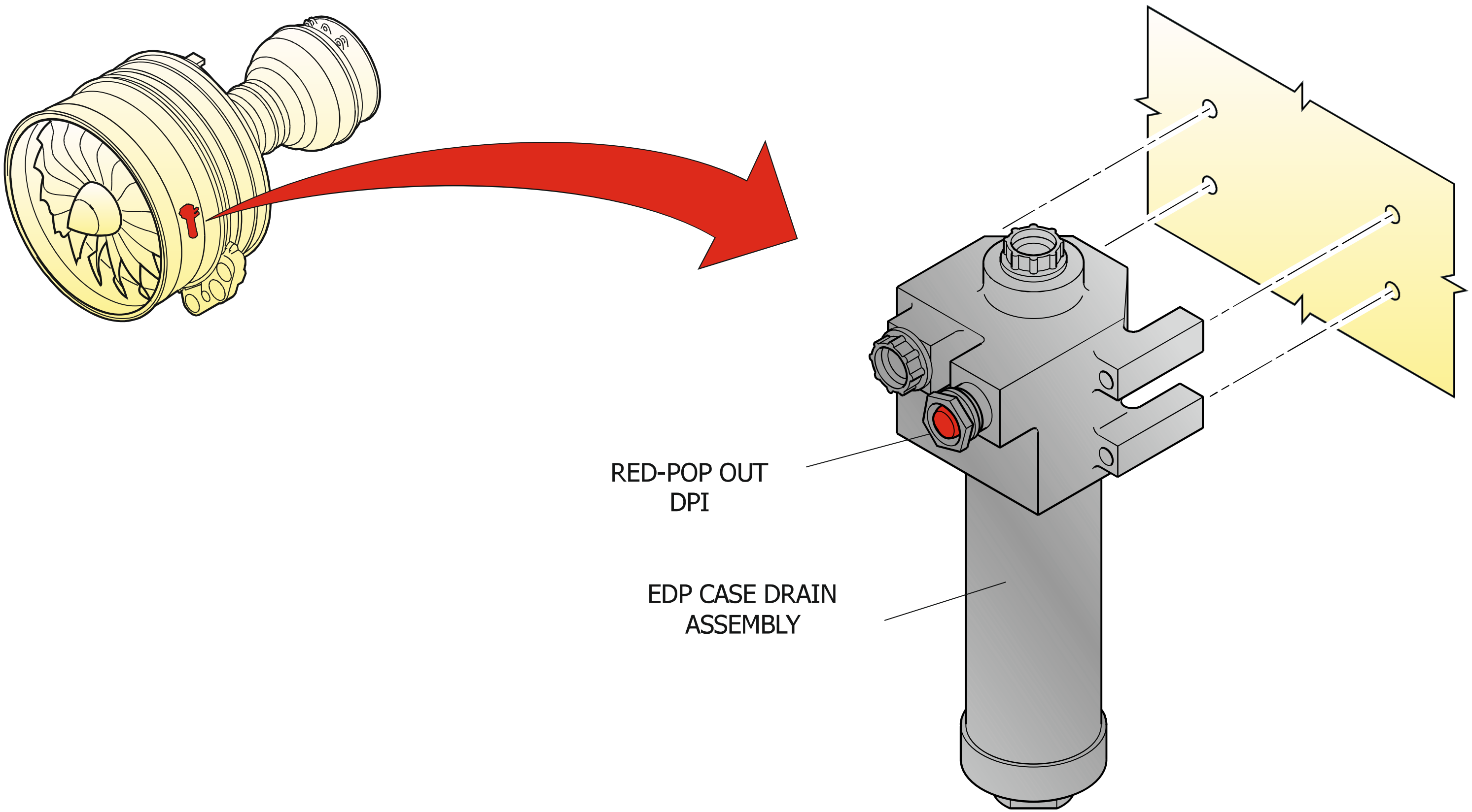
- the filter head,
- the filter bowl,
- the filter element.

The filter head includes the hydraulic connections and the mounting for the attachment of the filter to the structure. The filter head also includes the filter clogging indicator. The clogging indicator is a red pin which comes out to show that the filter element is too dirty. The indicator operates when the pressure differential across the filter is 6.0 + 0.6 - 0.6 bar (87.0 + 8.7 - 8.7 psi). When the red pin is pushed back in, the clogging indicator resets itself. The clogging indicator is latched magnetically. It does not operate if the temperature of the fluid is lower than 0 deg.C (32 deg.F). The indicator starts to operate again when the temperature of the fluid increases to 30 deg.C (86 deg.F).

An anti-spill device in the filter head operates when the filter element and bowl are removed. It stops fluid coming out of the system or air going in to it when the filter element is changed. The filter does not have a by-pass device to let fluid through if the element is clogged.

The filter bowl holds the filter element. It has a thread to attach it to the filter head. It is not necessary to use tools to tighten the filter bowl in the filter head. The filter element is of the replaceable type. It cannot be cleaned. The filtration rating of the element is 15 microns.

CASE DRAIN FILTER - LEAP-1A



DE-ICING SYSTEM PRESENTATION LEAP-1A - Level 1

GENERAL

USERS
The Nacelle Anti-Ice (NAI) System is designed to prevent ice formation on the engine inlet which could affect the engine operation. The engine air intake is heated during icing conditions using its related bleed air. The hot air is then discharged overboard.

SOURCE-
Hot air for the Nacelle anti-ice system is supplied by a dedicated HP Compressor (HPC) bleed:

- On the CFM-LEAP, 7th stage.

VALVE
The NAI System is controlled and monitored by the Propulsion Control System (PCS) (consisting of the Engine Electronic Controller (EEC) and Engine Interface Unit (EIU)).

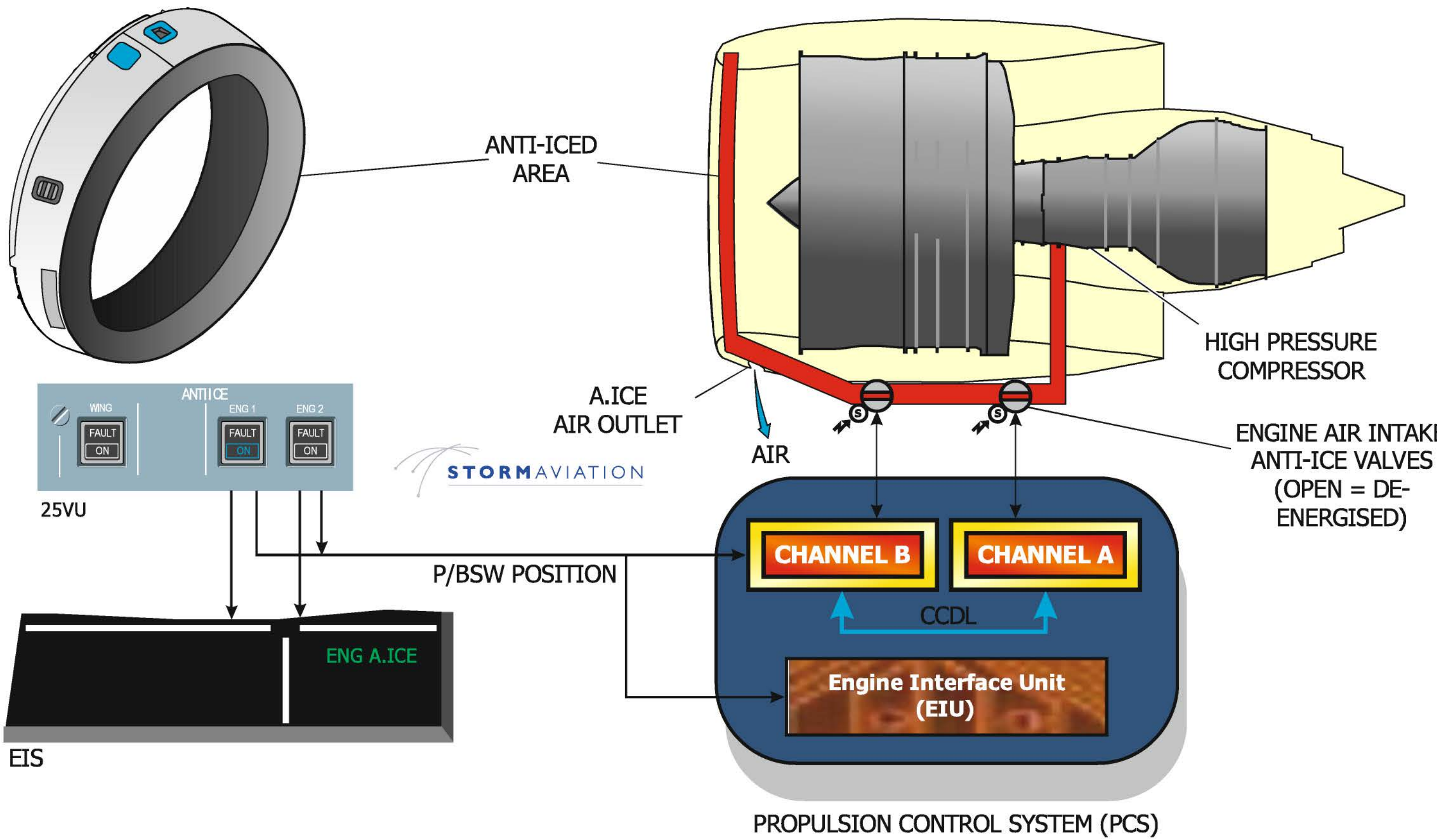
Each engine NAI System consists of two electrically controlled, pneumatically operated Pressure Regulating and Shut-Off Valves (PRSOV).

The EEC energizes the solenoid to CLOSE the PRSOV. Therefore, in case of loss of electrical power supply, the valves will go fully open provided the engine bleed air supply pressure is high enough. In the absence of air pressure, the valve is spring-loaded to the closed position.

CONTROLS
When the ENG ANTI ICE P/BSW is selected ON, signals are sent to EEC for controlling the valves and to the EIU to calculate the bleed decrements.

ECAM PAGE
If at least one of the two engine air intake anti-ice protection systems is selected ON, a message appears in green on the upper ECAM right MEMO. The EEC monitors the valve position through transducers and processes them to generate necessary indications and warning through the Flight Warning System (FWS). The FAULT indication in the PB S/W is activated by the PCS.

DE-ICING SYSTEM – GENERAL



ENGINE AIR INTAKE ICE PROTECTION SYSTEM DESCRIPTION LEAP-1A - Level 2 & 3

GENERAL

NAI SYSTEM

Each engine air intake has its own independent Nacelle Anti-Ice (NAI) protection system.

NAI System uses the hot bleed air from a dedicated engine bleed port.

- 7th stage High Pressure Compressor (HPC) for LEAP-1A

This bleed air is lead to engine air inlet through a feed duct which passes along the RH side of the engine core and fan case.

Each engine NAI system consists of one command P/B SW but two Pressure Regulating and Shut -Off Valves (PRSOVs) for good operability, two pressure Transducers (PTs), temperature protection and supply ducts.

Both PRSOVs are located on the engine core.

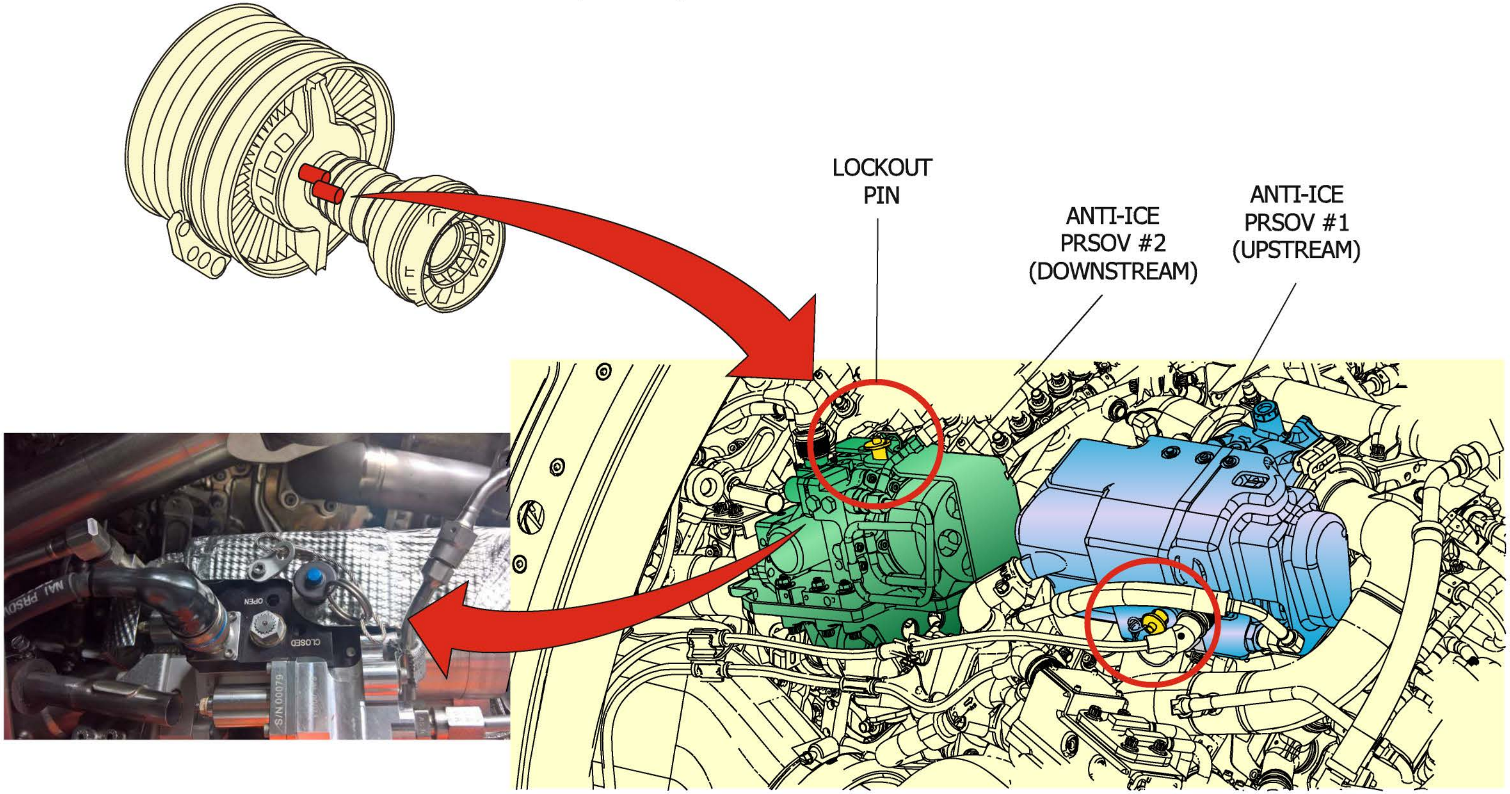
- Left Hand (LH) side, 11 o'clock for LEAP-1A

The two PRSOVs are in series.

They can be locked open or closed independently for MEL dispatch purposes, however you cannot lock both valves open.

Note: The LEAP-1A also incorporates a booster intake anti-ice system. This is fully automatic and under the control of the EEC. It is covered in ATA 76.

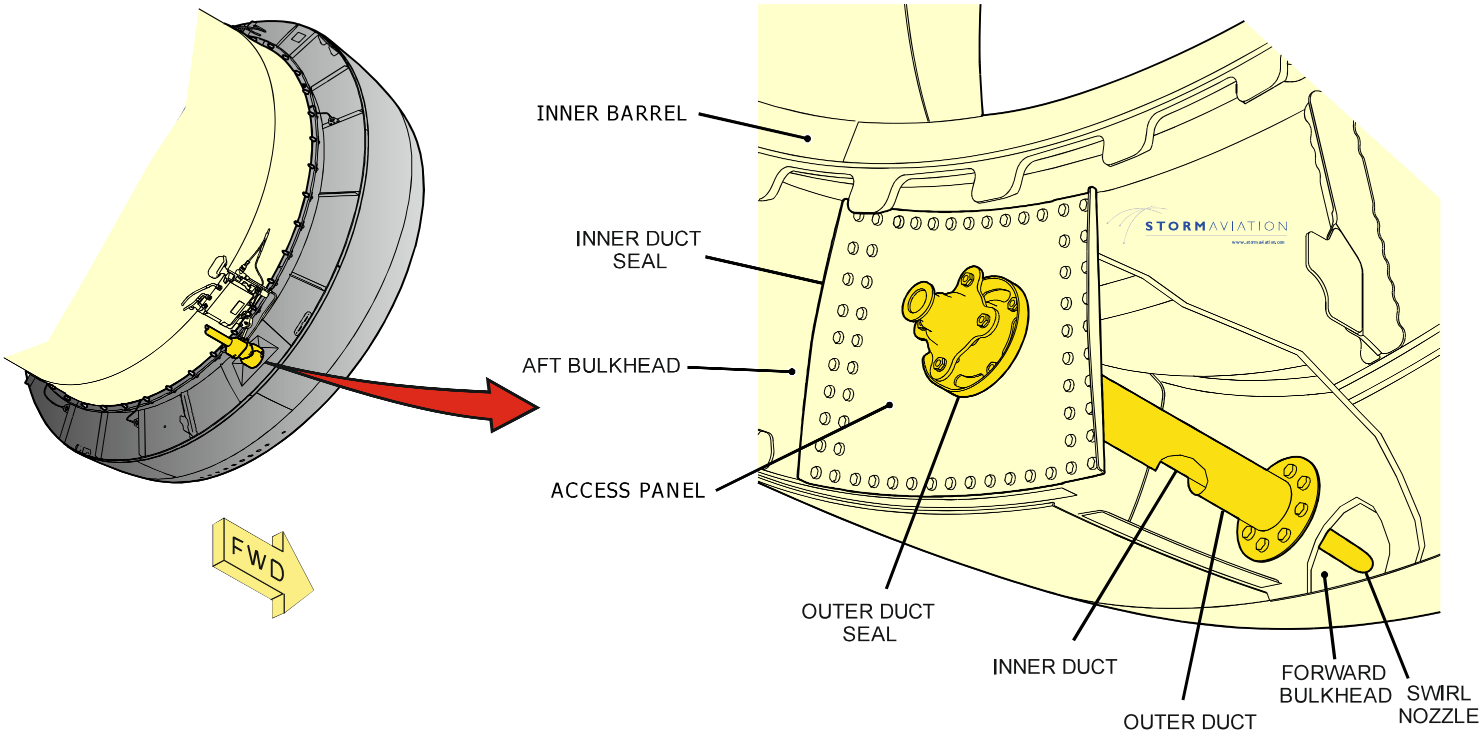
ENGINE AIR INTAKE NACELLE ANTI-ICE GENERAL (LEAP-1A) - 1



AIR INLET COWL

The air is released into the air intake lip (D-Duct) through a swirl system which mixes the air and injects it in a specific pattern for effective heating. The airflow exits the air intake lip by a single exhaust grid at the bottom of the nacelle outside the fan which has 6 oval holes.

ENGINE AIR INTAKE AIR INTAKE COWL - LEAP-1A



ENGINE AIR INTAKE ICE PROTECTION SYSTEM DESCRIPTION NEO - continued

PRSOV CONTROL AND OPERATION LEAP-1A

GENERAL

The NAI system is controlled and monitored by the Propulsion Control System (PCS) (Engine Electronic Controller (EEC) and Engine Interface Unit (EIU)). The EEC controls the PRSOV operation by energizing/de-energizing the solenoids. PRSOV 1is controlled by EEC Channel A and PRSOV 2 is controlled by Channel B. Each PRSOV pneumatically regulates the downstream air pressure.

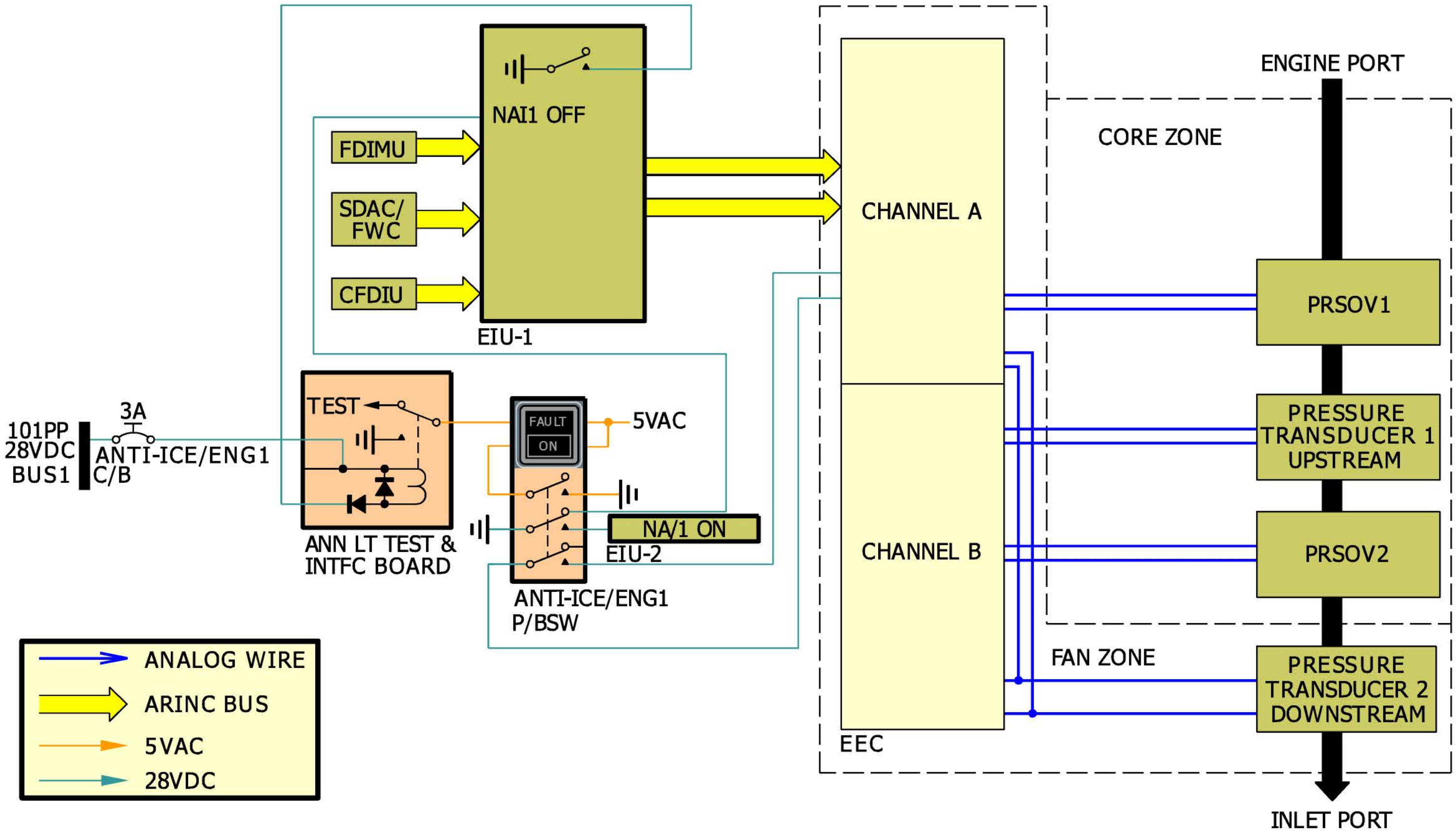
When the NAI PB S/W is selected to 'ON' position, the EEC de-energizes the solenoid valves of PRSOV to OPEN the valves. Only when both the valves are open the bleed air is fed to the engine intake lip.

The PRSOV 1 regulates the upstream pressure then in cascade, the PRSOV 2 controls downstream pressure at different threshold. In normal operation, the two PRSOVs always regulate in cascade.

When the engine operates, the ECC channel controls the PRSOVs as follows:

- If its own valve is not detected failed open ('Upstream NAIV Failed Open' is false for channel A or 'downstream NAIV Failed Open' is false for channel B), the channel in control energizes its own solenoid
- If the valve controlled by the channel in control is detected failed open ('Upstream NAIV Failed Open' is true for channel A or 'Downstream NAIV Failed Open' is true for channel B), the channel that is not in control energizes its own solenoid

PRSOV CONTROL AND OPERATION - LEAP-1A



MONITORING LEAP-1A

The EEC does a detailed monitoring of the PRSOVs with two PTs (PT1 & PT2) located downstream each PRSOV.

PT1 is located in between the PRSOVs.

- For LEAP-1A, It gives the feedback to channel A only and use for troubleshooting.

PT2 is located downstream of PRSOV 2. It gives the feedback to both the EEC channels for monitoring function in case of single failure of EEC channel.

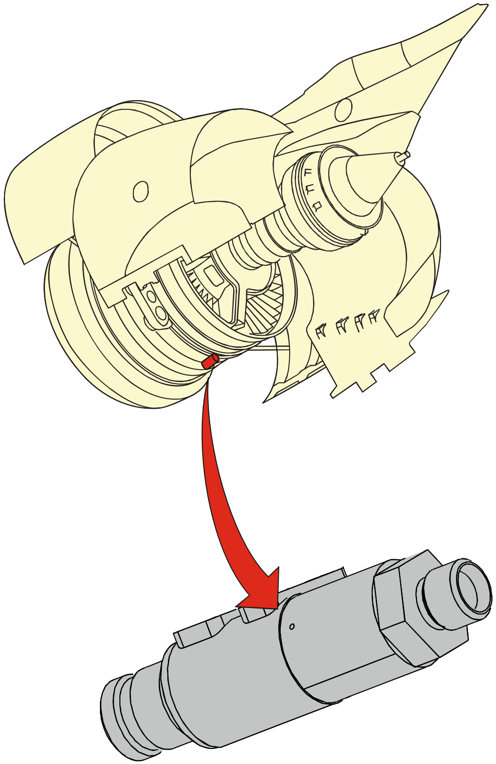
A dual temperature sensor located in the fan case, provides the EEC (one per channel) with the fan compartment temperature measurement for NAI leakage detection.

- 6 o'clock LEAP-1A.

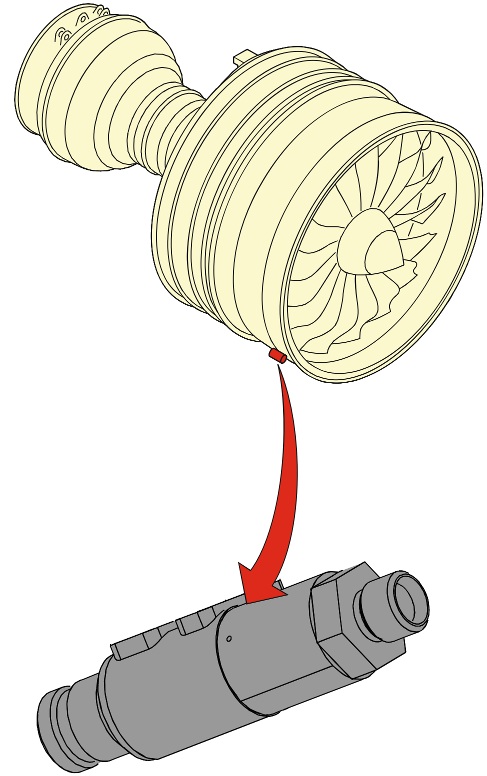
When the engine is running and a "Hot Air Leakage" event is detected, the EEC energizes PRSOVs solenoids, which provide the isolation function.

Note: For the CFM LEAP-1A Channel A & B refers to EEC A & EEC B respectively.

PRSOV CONTROL, OPERATION AND MONITORING (LEAP-1A)



UPSTREAM PRESSURE TRANSDUCER



DOWNSTREAM PRESSURE TRANSDUCER

ENGINE ANTI ICE P/BSW

The P/B SW sends a discrete signal to the EEC to operate the PRSOVs. The P/B SW position and the opposite engine P/B SW position are monitored by the EIU for computing the bleed decrements.

The "FAULT" light is triggered by the EIU based on the input from EEC. It appears when the engine is running and NAI is failed in OPEN or CLOSED. It also appears in case of monitoring fault.

Propulsion Control System (PCS) (EEC and EIU)

The EEC controls the PRSOV to open when the P/B SW is set to ON. The EEC monitors the position of the PRSOV by the two NAI transducers to trigger associated fault messages.

The System Data Acquisition Concentrator/Flight Warning System (SDAC/FWS), Flight Data Interface and Management Unit (FDIMU) and Centralized Fault Display Interface Unit (CFDIU) interfaces with the PCS.

FAILURE CONDITION

The fail safe position of the valves in case of EEC dual channel failure is OPEN.

In case of a single valve failure, the corresponding valve being failed open, the anti-ice function is still available.

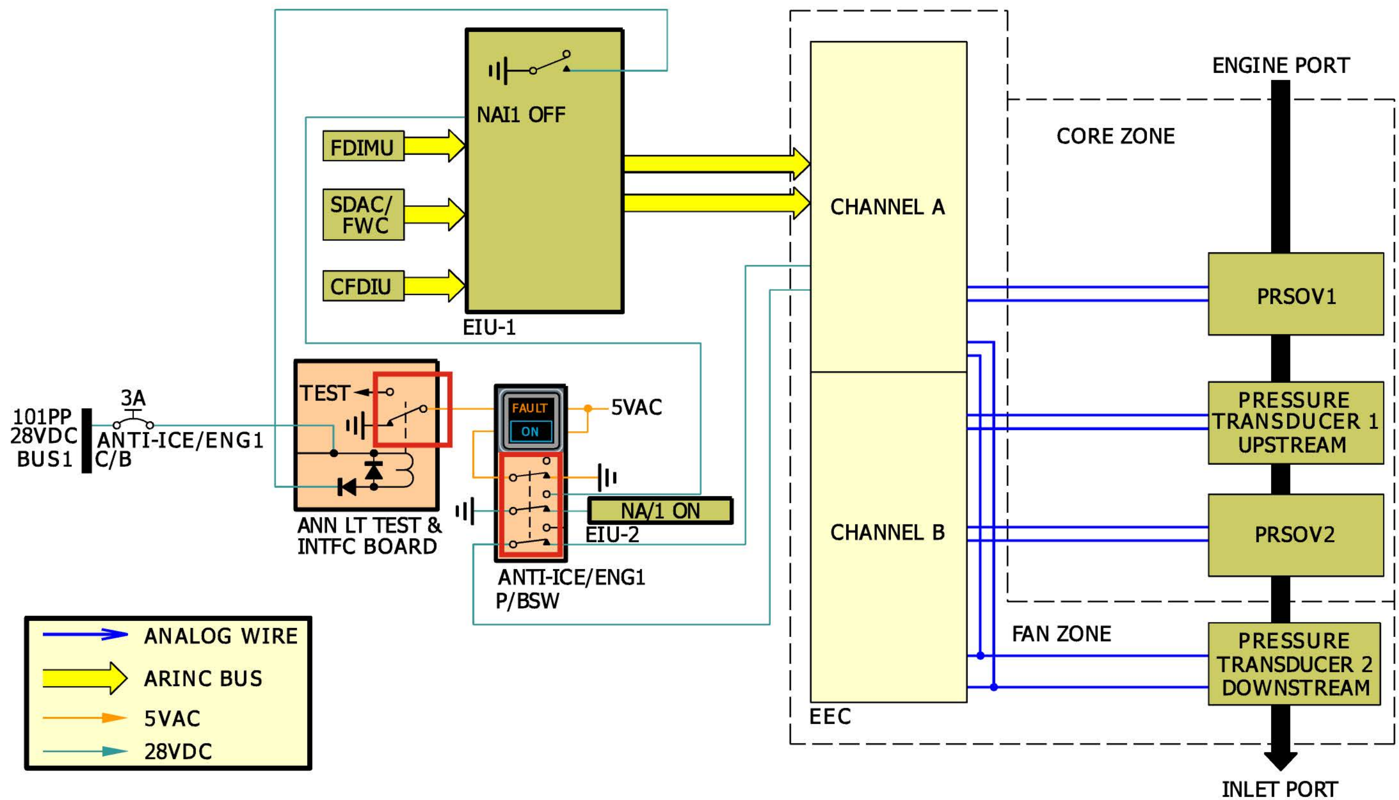
The two pressure Transducers (PT1 for core zone and PT2 for fan zone) monitors leak or burst scenarios and a dual fan case thermocouple helps in identifying over temperature conditions due to leaks or burst. The EEC monitors the same and generates warning messages to the FWS. A hot air leak causes the EEC to energise the PRSOVs closed.

Minimum Equipment List (MEL) IMPACT- The aircraft can be dispatched with one valve locked open on each engine (ref 30-21-01).

Note: For the CFM LEAP-1A, there is a special function for dispatch available through the MCDU.

Note: For the CFM LEAP-1A Channel A & B refers to EEC A & EEC B respectively.

PRSOV CONTROL, OPERATION AND MONITORING - LEAP-1A



PRSOVs ACTIVATION/DEACTIVATION OF THE PRSOVS - LEAP-1A

The NAI PRSOV 1(2) can be deactivated through the manual override control, in the open or closed positions.

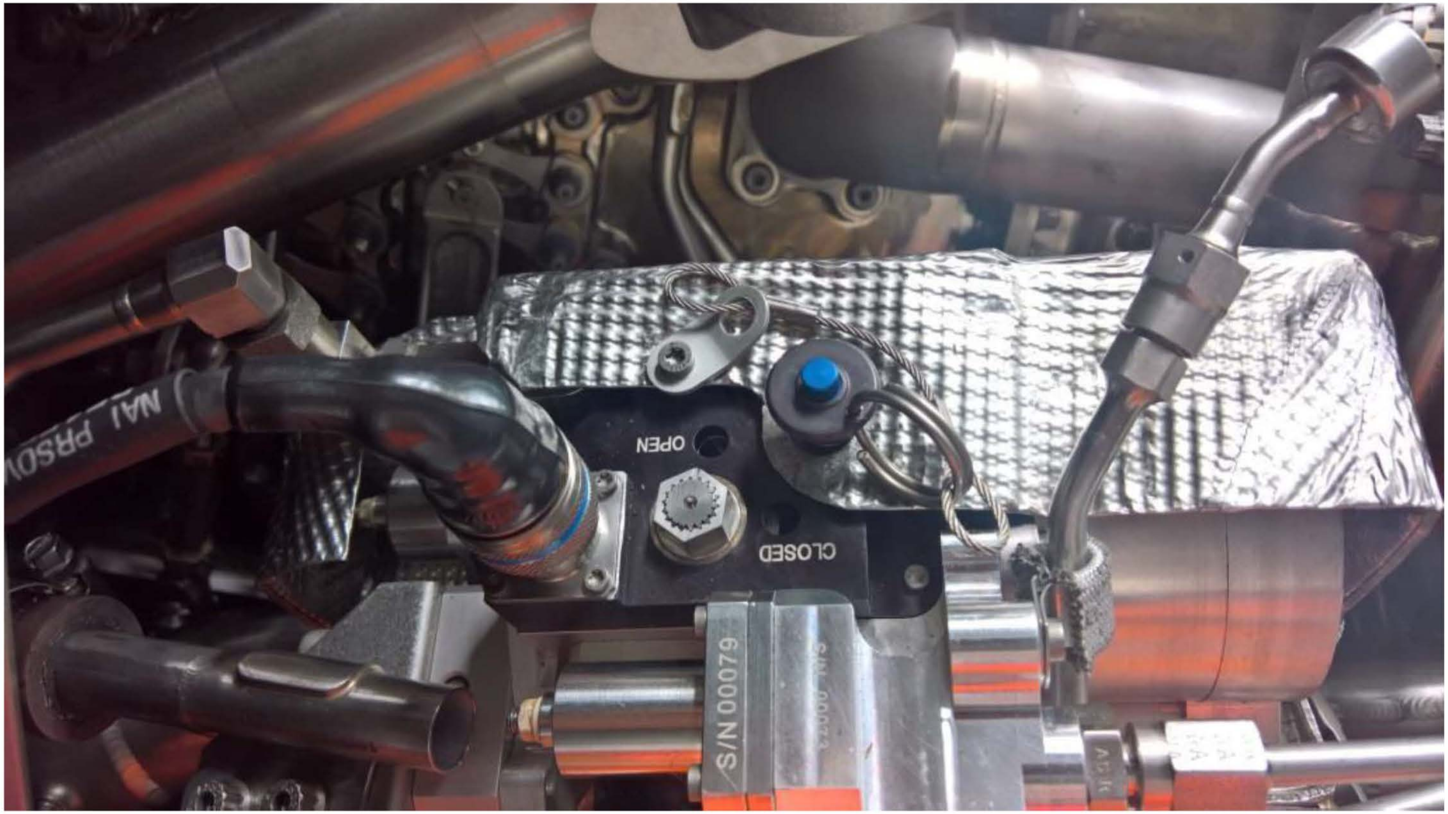
Depending on dispatch conditions you may:

Lock one valve OPEN (the other valve continues to regulate the air pressure).

Lock both valve closed (depending on weather criteria).

You may NOT dispatch with both valves open.

PRSOVS ACTIVATION/DEACTIVATION OF THE PRSOVS - LEAP-1A



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IAE PW1100G - DIFFERENCES

ELECTRICAL POWER GENERATION SYSTEM PW1100G - Level 3

GENERAL

Each engine has am Integrated Drive Generator (IDG). The IDG converts the variable-speed shaft power directly into constant frequency 400 Hz AC electrical power. The Constant Speed Drive (CSD), in the IDG, drives the AC generator at constant speed. Thus, the AC generator produces constant frequency power.

Note: The electrical distribution system is identical to the CEO Enhanced aircraft fleet.

INTEGRATED DRIVE GENERATOR (IDG)

The IDG has an automatic and a manual thermal disconnect-mechanism. The manual disconnect mechanism has a solenoid, a spring-loaded disconnect plunger, a cam shaft and a reset ring. The crew pushes the IDG pushbutton switch when the IDG FAULT legend comes on. When activated, the IDG cannot be reconnected in flight.

It is reset via the IDG pull ring on the ground with the engine stationary.

At an IDG oil temperature of 199 deg.C (390.2 deg.F), an automatic thermal disconnect-mechanism disconnects the IDG. When this occurs, the IDG must be changed.

The IDG has standard connections for filling/draining and a sight glass indicating IDG oil level.

The IDG has scavenge and charge filters .The scavenge filter has a DPI 'pop-out' indication when in bypass.

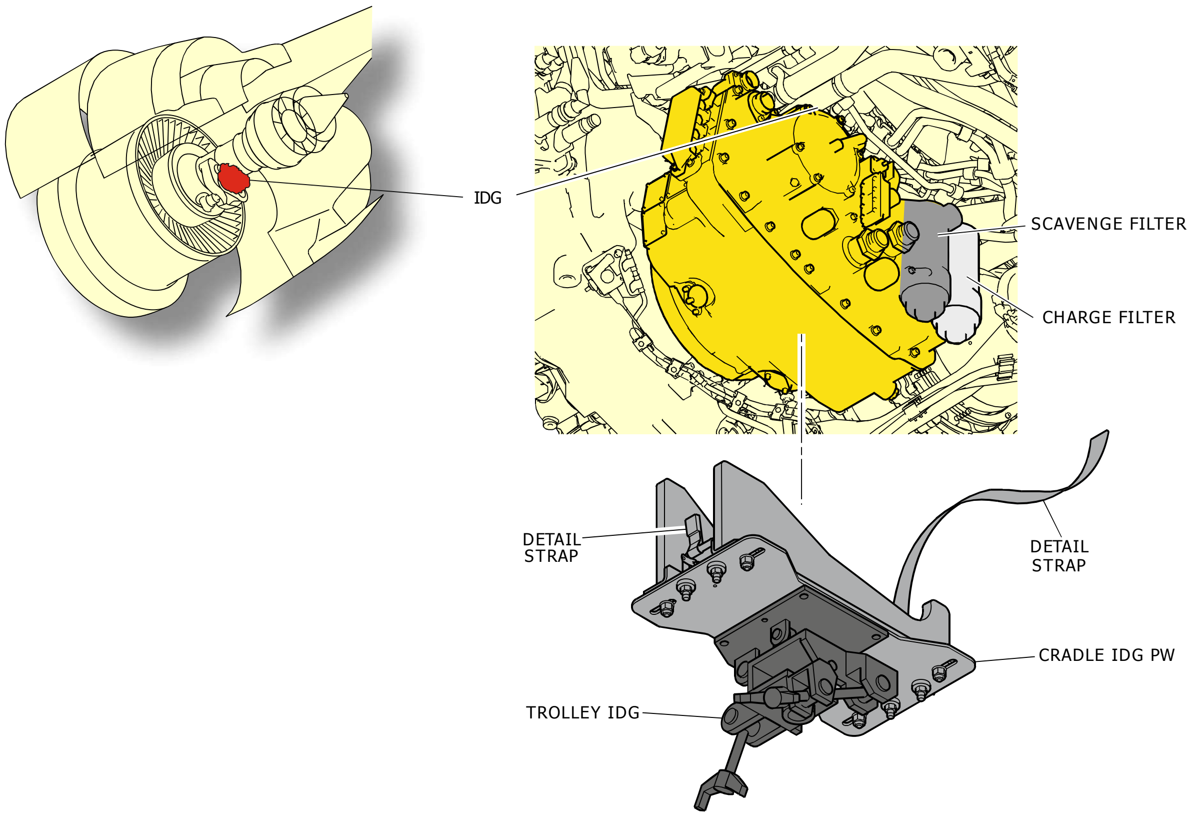
IDG OIL FILTER DIFFERENTIAL PRESSURE INDICATOR (DPI)

The scavenge filter has an oil filter DPI. The indicator shows when it is necessary to replace the oil filter elements. The sensing device for the oil filter DPI is automatically inhibited during cold oil-running conditions. This prevents unwanted operation because of a high oil viscosity.

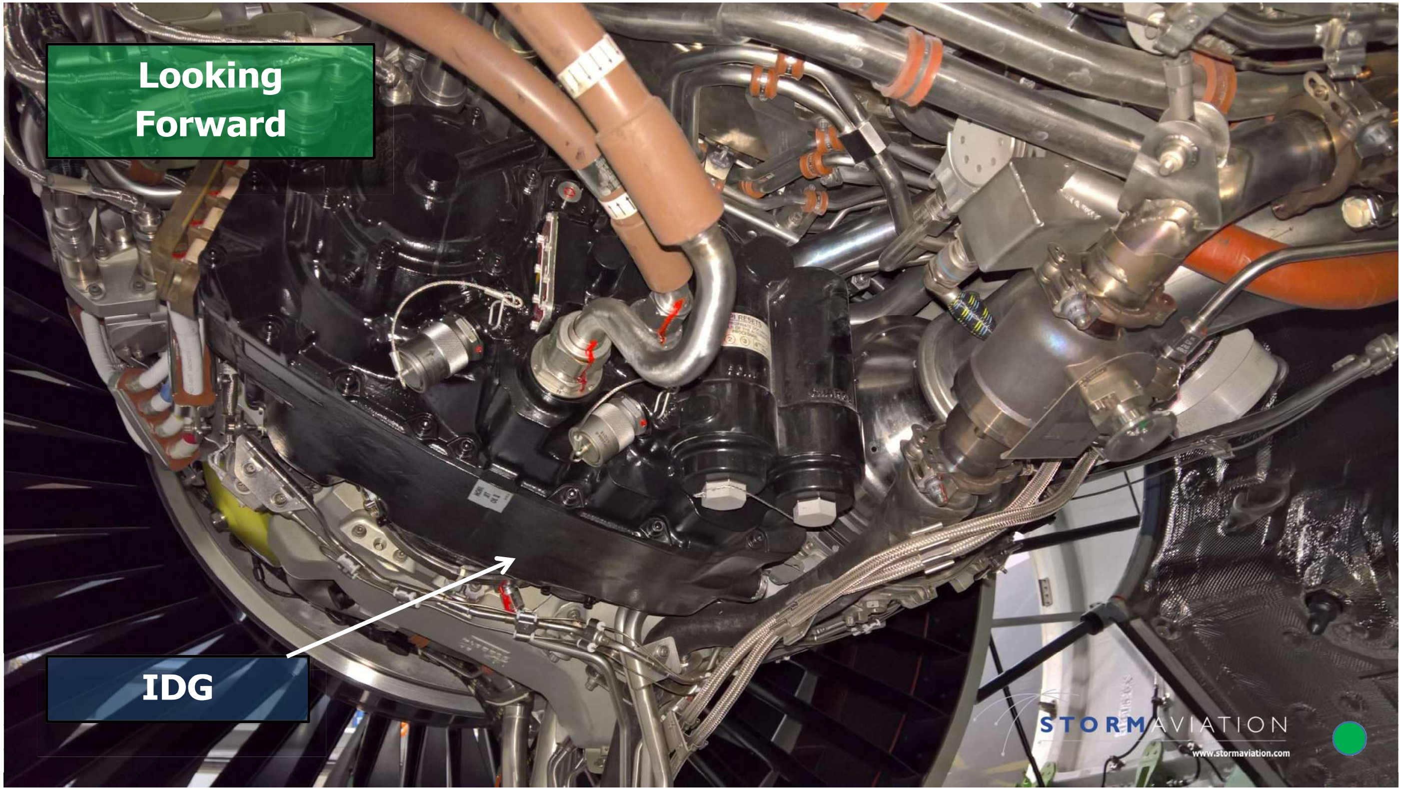
The clogging indicator of the oil scavenge filter is on the IDG oil-out line.

It is necessary to replace the two filters elements when the DPI is extended.

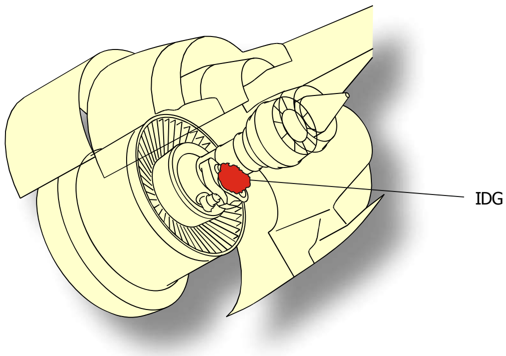
INTEGRATED DRIVE GENERATOR (IDG) PW1100G - 1

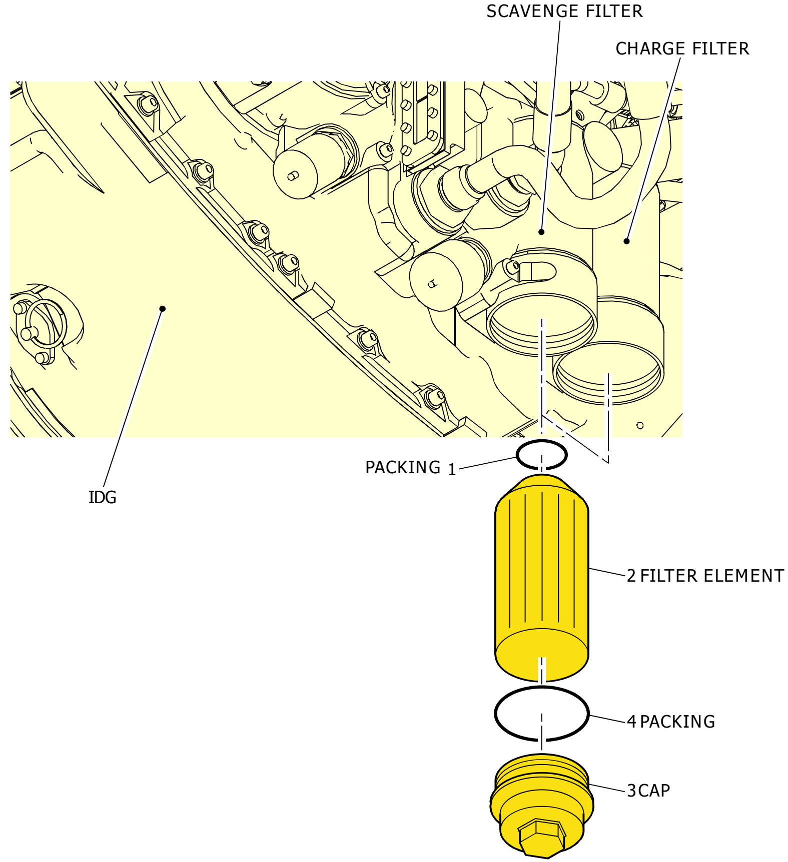


INTEGRATED DRIVE GENERATOR (IDG) PW110G - 2



IDG - SCAVENGE AND CHARGE FILTERS PW1100G





FUEL COOLED (IDG) OIL COOLER (FCOC) PW1100G

The fuel-cooled IDG oil cooler cools the IDG oil and limits the IDG inlet temperature. As the oil goes through the oil cooler, heat is transferred from the oil to the fuel. Then the cooled oil returns to the IDG.

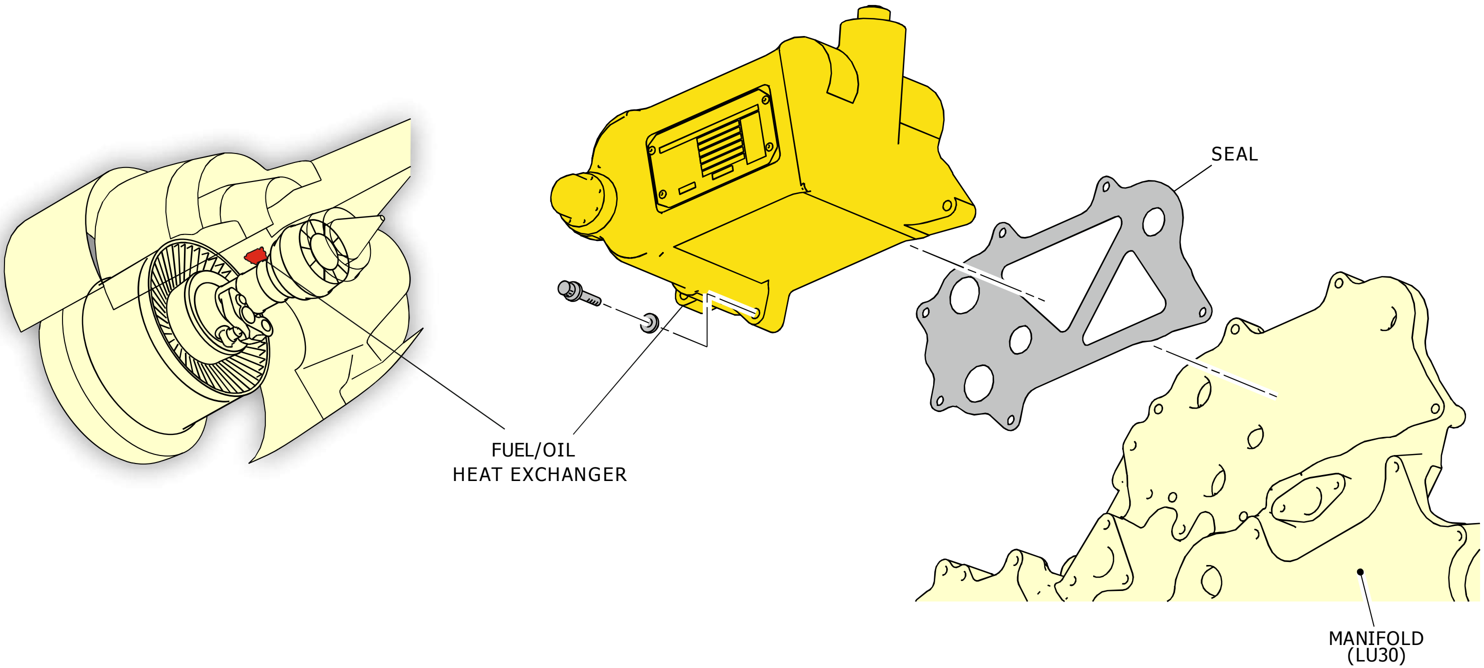
Note: The normal IDG oil-inlet temperature is between 70 C° and 105 C°.

It forms part of the Thermal Management System (TMS).

Note: It also referred to as the IDG Fuel/Oil Heat Exchanger.

The FCOC is covered in AMM 79-21-08.

FUEL COOLED OIL COOLER (FCOC) PW1100G - LOCATION



IDG OIL/OIL HEAT EXCHANGER PW1100G

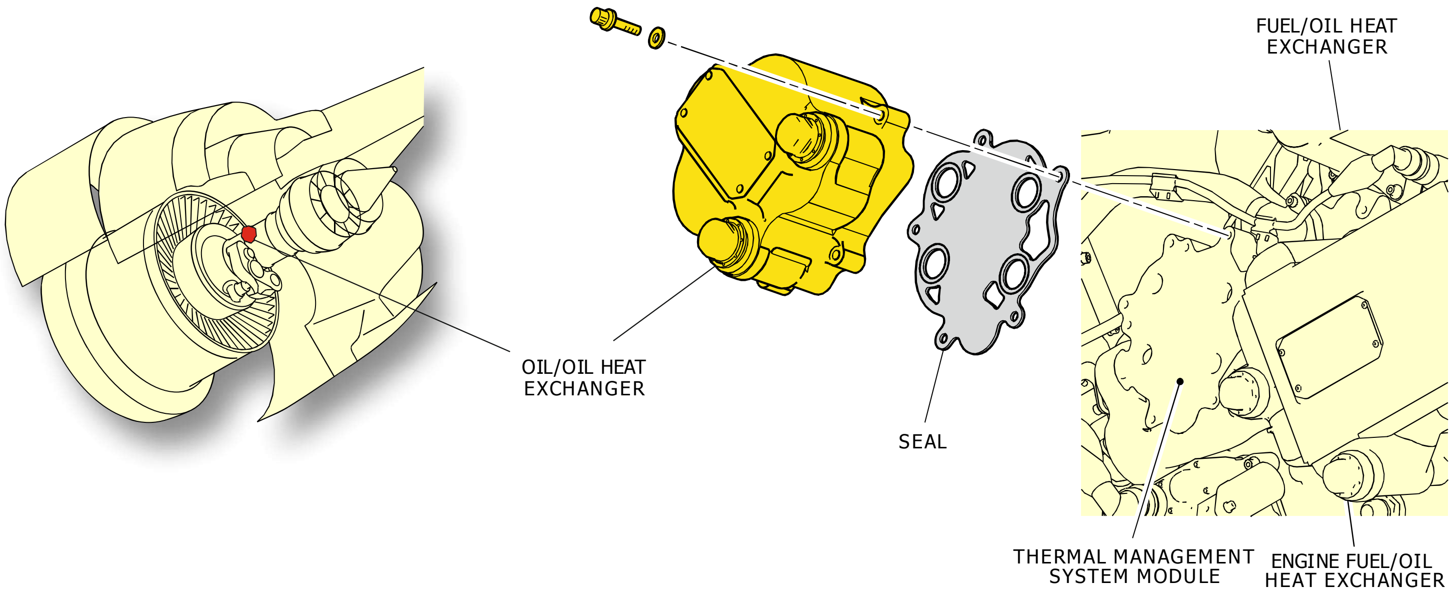
An IDG oil/oil heat exchanger is installed downstream of the air/oil heat exchanger and fuel/oil heat exchanger. It uses engine oil to cool the Integrated Drive Generator (IDG) oil. In some conditions, such as hot day ground idle, heat is transferred from the oil/oil heat exchanger to the engine oil.

The oil/oil heat exchanger has a bypass valve which is mechanically operated.

This forms part of the Heat Management System (HMS).

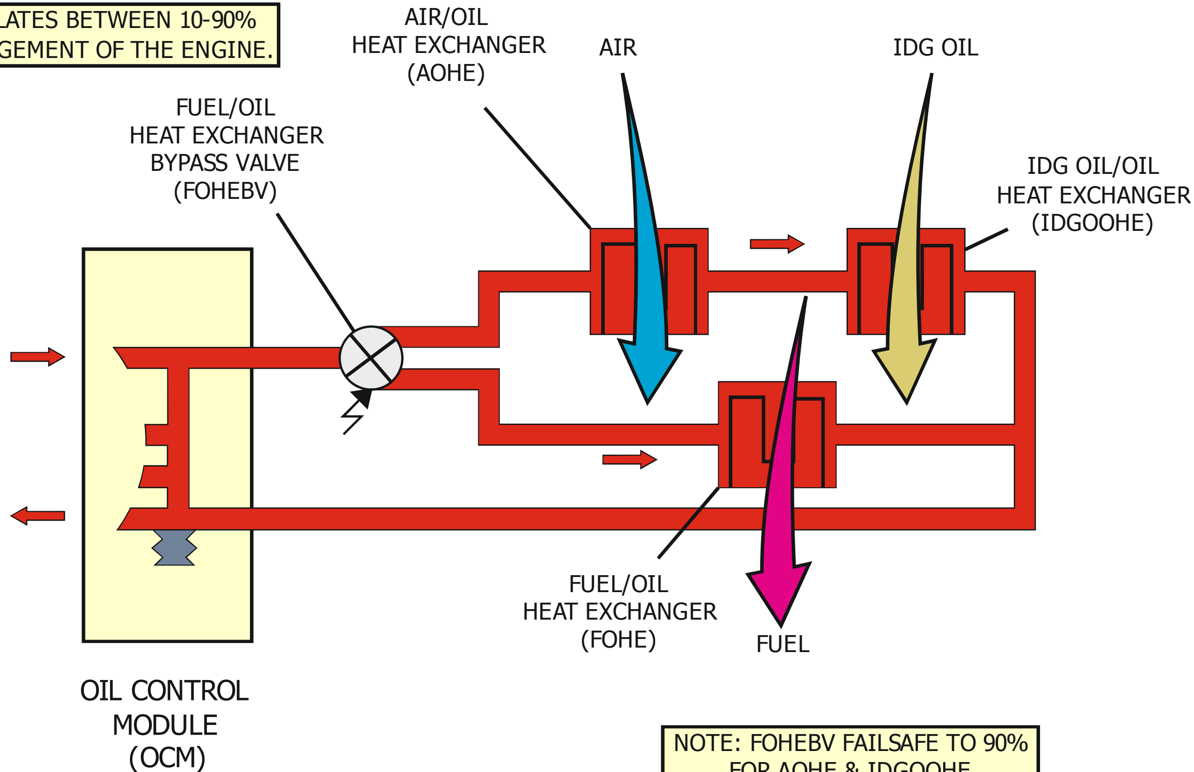
The IDGOOHE is covered in 24-21-42.

IDG OIL/OIL HEAT EXCHANGER PW1100G - LOCATION



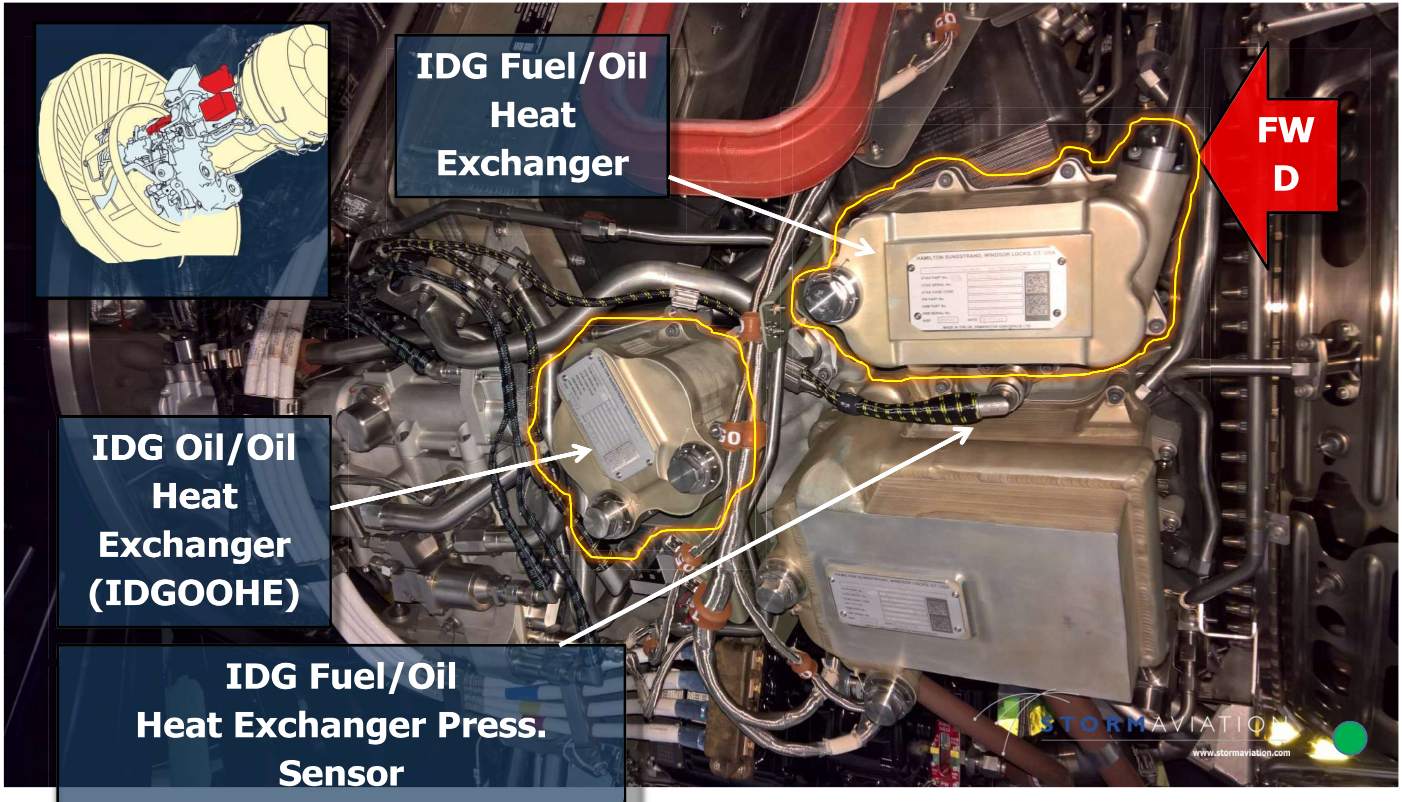
IDG OIL/OIL HEAT EXCHANGER PW1100G - SYSTEM

FOHEBV MODULATES BETWEEN 10-90% FOR HEAT MANAGEMENT OF THE ENGINE.



NOTE: FOHEBV FAILSAFE TO 90% FOR AOHE & IDGOOHE

IDG OIL/OIL HEAT EXCHANGER & FUEL COOLED OIL COOLER (FCOC) PW1100G - LOCATION



FIRE PROTECTION SYSTEM COMPONENT LOCATION PW1100G - Level 3

SYSTEM OVERVIEW

The engine fire protection is performed by two sub-systems:

- FIRE detection system
- FIRE extinguishing system.

ENGINE FIRE PROTECTION

The engines have individual fire detection systems. Each system has two identical detection loops (A and B) installed in parallel. Each loop includes 3 detector elements.

These detection elements are located around the Accessory Gear Box (AGB), core engine area and pylon area.

The two loops are monitored by a Fire Detection Unit (FDU). FDU 1 monitors the loops on engine 1 and FDU 2 monitors the loops on engine 2.

The FDU sends FIRE and FAULT signals to the Flight Warning Computer (FWC) for display on ECAM.

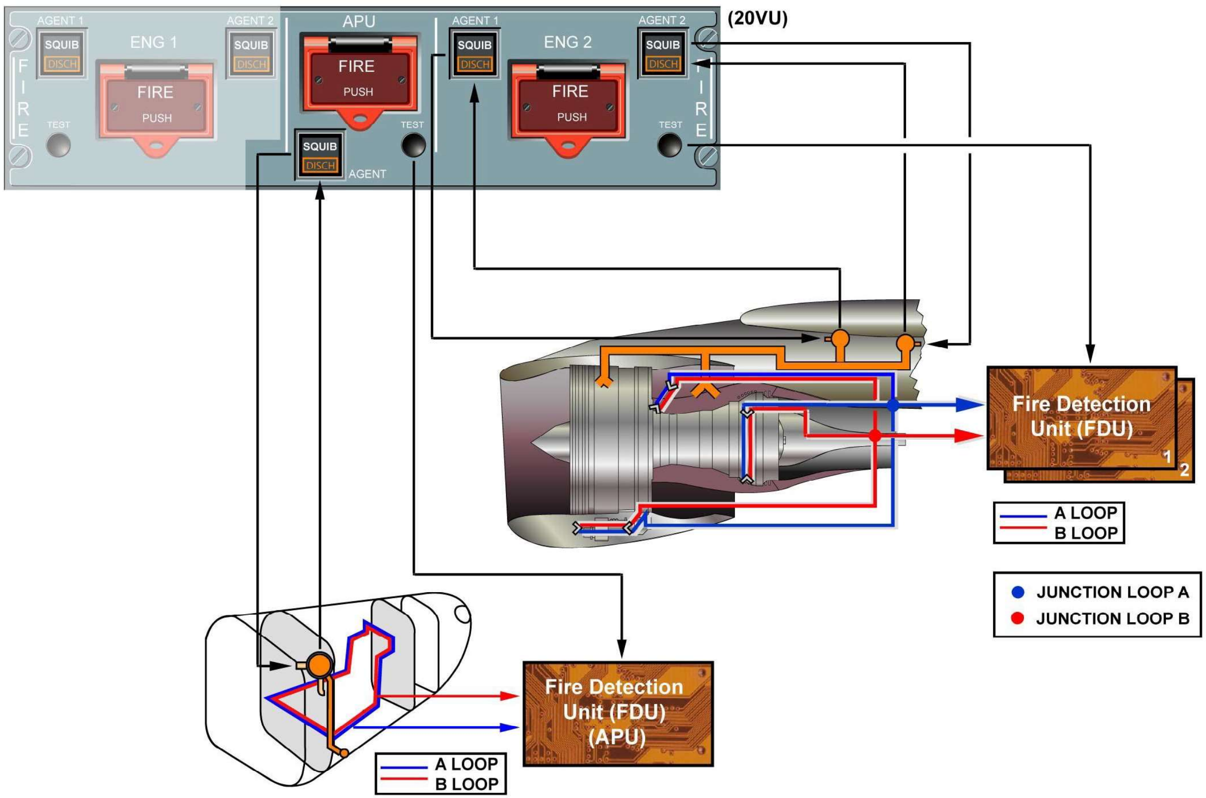
Each engine has 2 fire bottles installed in the pylon.

The discharge of each bottle is controlled by a related AGENT P/BSW on the FIRE panel.

The TEST buttons are used to do tests on the different fire detection and extinguishing systems and make sure they operate correctly.

- The PW1100G has 4 fire detectors (pylon, AGB, fan grill and core).

SYSTEM OVERVIEW - ENGINE AND APU FIRE DETECTION & ENGINE AND APU FIRE EXTINGUISHING (PRINCIPLE CEO & NEO)

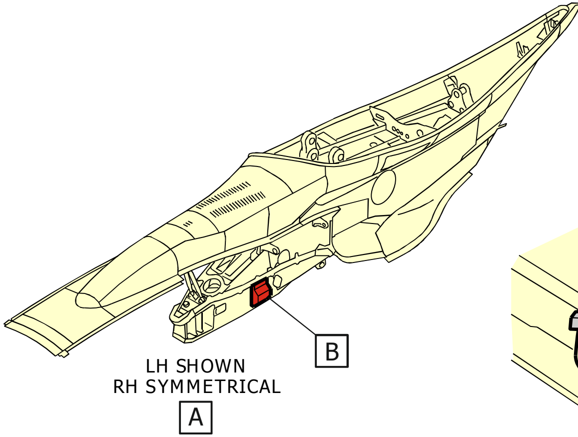


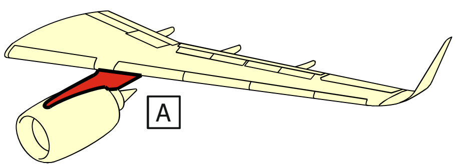
FIRE DETECTION LOOPS PW1100G & LEAP-1A

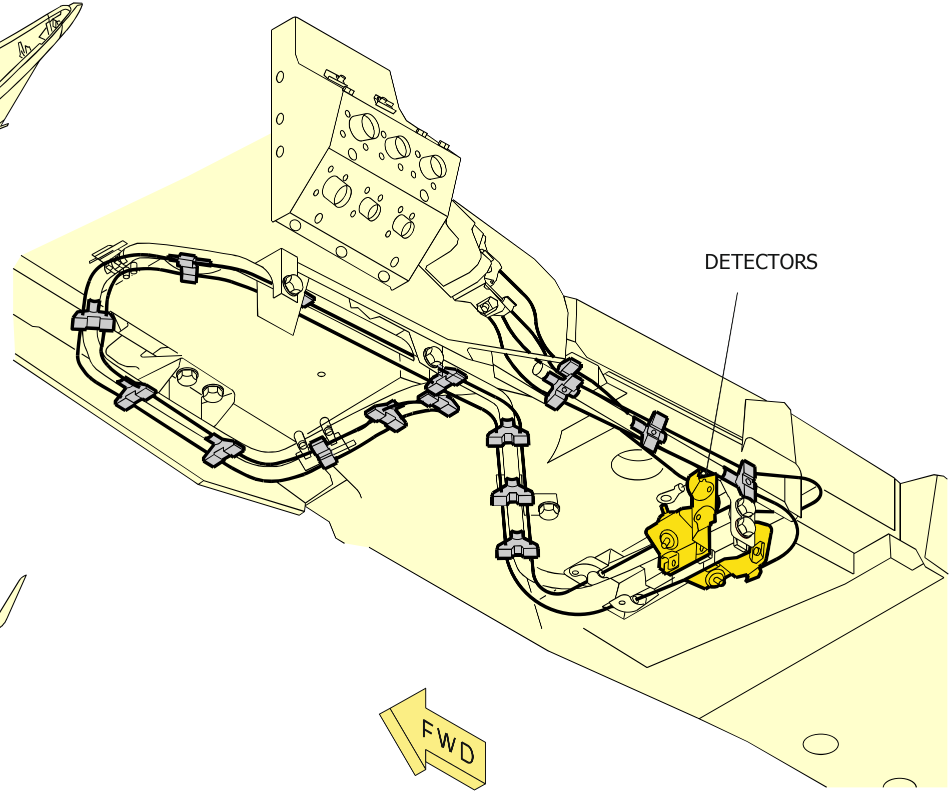
On each engine, there are two continuous loops for the fire detection system. Each fire detection loop has three fire detectors connected in parallel. They are installed in pairs (loop A/loop B):

- At the pylon forward mount
- On the engine gearbox
- On the engine case N-flange.

FIRE DETECTION LOOPS PW1100G & LEAP-1A - PYLON





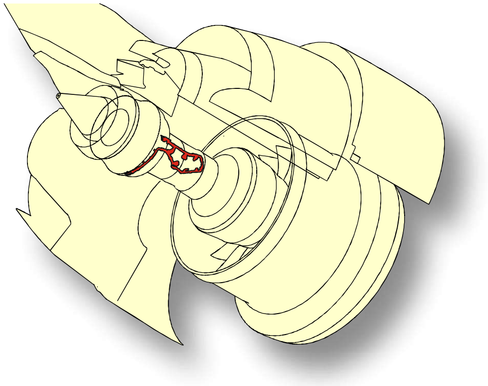


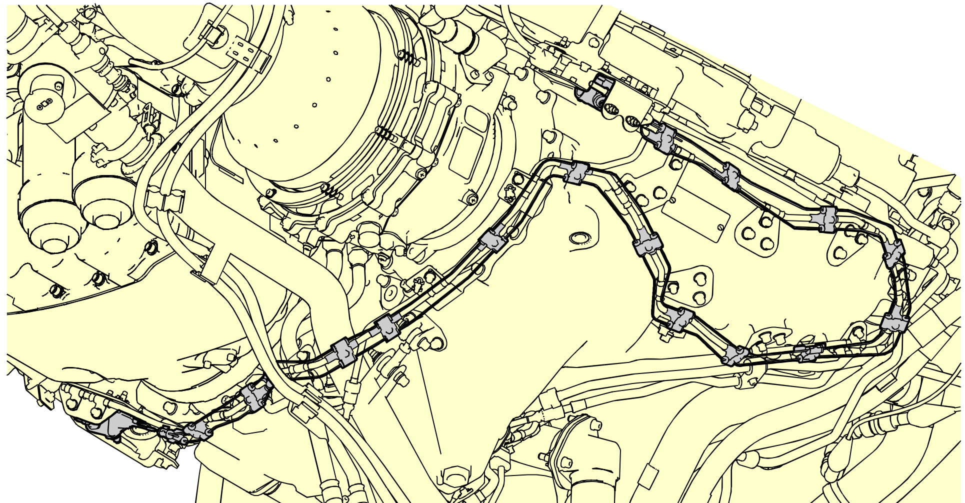
FIRE DETECTION LOOPS - MAIN GEARBOX PW1100G

For Pratt and Whitney (PW1100G) engine, the accessory gear box is located in the Core engine area.

The fire detection and extinguishing principle is identical on all Single Aisle family (CEO and NEO).

FIRE DETECTION LOOPS PW1100G - MAIN GEARBOX





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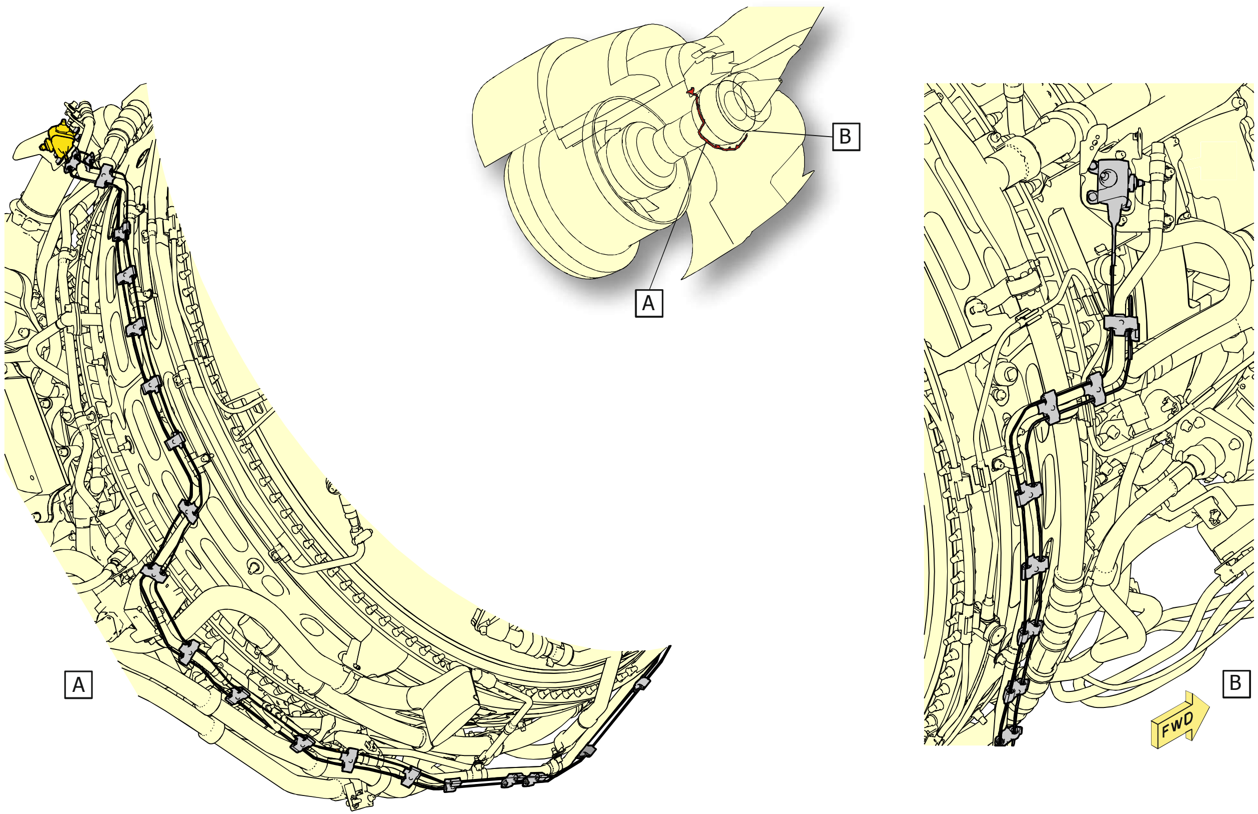
FIRE DETECTION LOOPS PW1100G - REAR LOOP



FUEL RETURN TO TANK SYSTEM PW1100G - Level 3

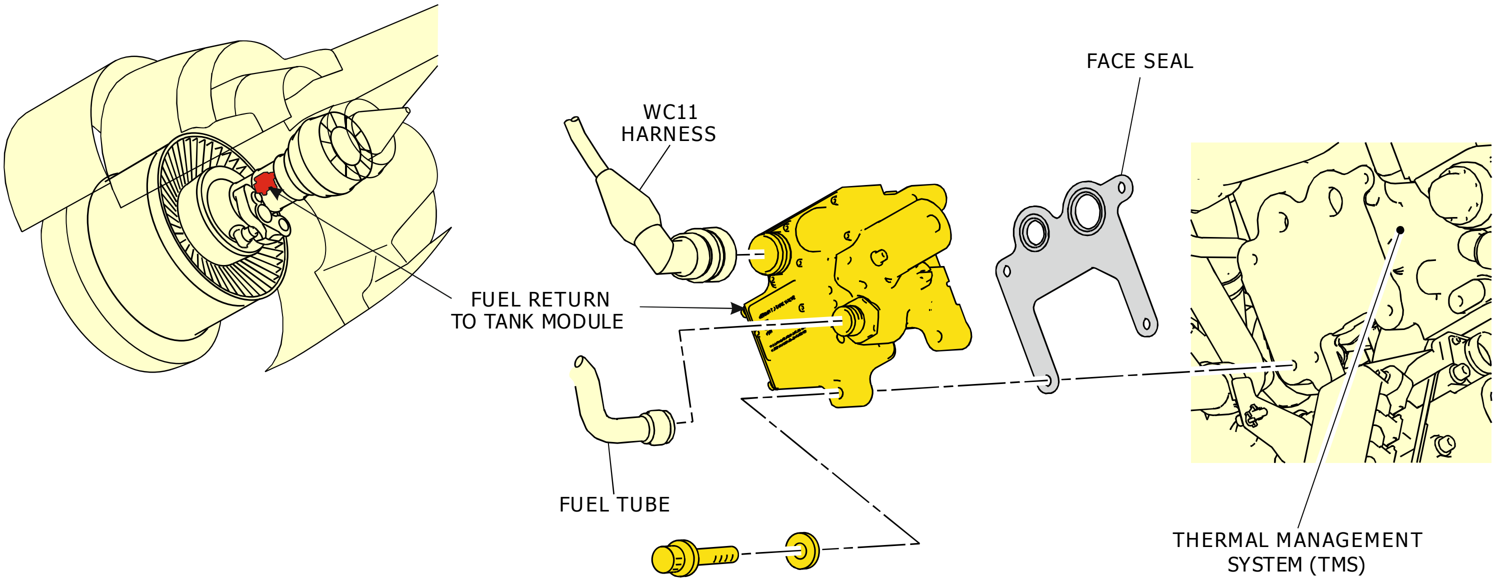
GENERAL

Note: The operation is the same for PW1100G and LEAP-1A NEO types.

The temperature of the Integrated Drive Generator (IDG) oil is decreased by fuel through a recirculation system. Some of the fuel that supplies the engines is used to decrease the temperature of the IDG oil. A Fuel Return To Tank valve (FRTT) lets the hot fuel return to the outer cell. The FRTT opens the fuel flow back to the aircraft tank in special engine configurations (N2, fuel flow...). The return valve mixes the hot fuel with cold fuel from the Low Pressure (LP) fuel pump to keep the temperature of the returned fuel less than 100°C (212°F). The Fuel Level Sensing Control Unit (FLSCU) 1 and the Engine Electronic Control (EEC) 1 control the recirculation system in the left wing. FLSCU 2 and EEC 2 control the right wing system.

This system works in the same manner to CEO aircraft except for the location of the Fuel Return To Tank valve (FRTT), which is also referred to as the Fuel Return To Tank Module.

FUEL RETURN TO TANK VALVE PW1100G (MODULE)



HYDRAULIC SYSTEM PRESENTATION PW1100G - Level 3

ENGINE DRIVEN PUMP

A splined quill drive connects the gearbox to the input shaft of the pump. The quill drive is made to shear if the pump cannot turn. The attachment flange of the pump has keyhole slots where the installation bolts are. On the PW1100G, a heat shield is installed between the MGB and the EDP.

The suction line connection has a quick-release, self-sealing coupling. Together, they make it possible to replace the pump quickly. The pump is of the variable-displacement type. The rotating assembly turns all of the time that the engine operates. The pump has nine pistons which are connected to a moveable yoke plate. When the angle of the yoke plate changes, the stroke of the pistons changes and the output of the pump is increased or decreased. The compensator valve supplies servo pressure to the actuator piston, which controls the angle of the yoke.

A solenoid valve (controlled from the flight compartment) makes it possible to change the operation of the pump so that it does not supply pressure to the system (depressurized mode). The EDP includes a blocking valve which isolates the pump from the hydraulic system when the pump operates in the depressurized mode. In the depressurized mode the outlet of the pump is connected internally directly to the inlet of the pump. The pump then operates with an internal pressure of approximately 1000 psi (70 bar), with zero flow. This is the pressure necessary on the actuator piston to reduce the angle of the yoke to near zero when the outlet and control pressures are balanced.

A case pressure relief valve connects the fluid in the EDP case to the inlet of the pump if the pressure of the fluid in the case is too high (for example if the case drain pipe is blocked). A pump inlet boost impeller is included in the EDP which increases the pressure of the fluid at the inlet of the pump. This makes certain that the chambers of the pump get a sufficient supply of fluid at all conditions of operation. Seal drain fluid goes into a container, which is also used to collect oil from the accessory gearbox. The fluid from the two components is kept divided.

Thus it is possible to find if the leakage of fluid past the seals of the pump or gearbox is too high. The EDP supplies fluid at 206 + 3 -0 bar (3000 +43 -0 psi) at zero delivery and a flow of 150 l/min (39.6 US gal) at a speed of 3982 rpm (100% engine speed).

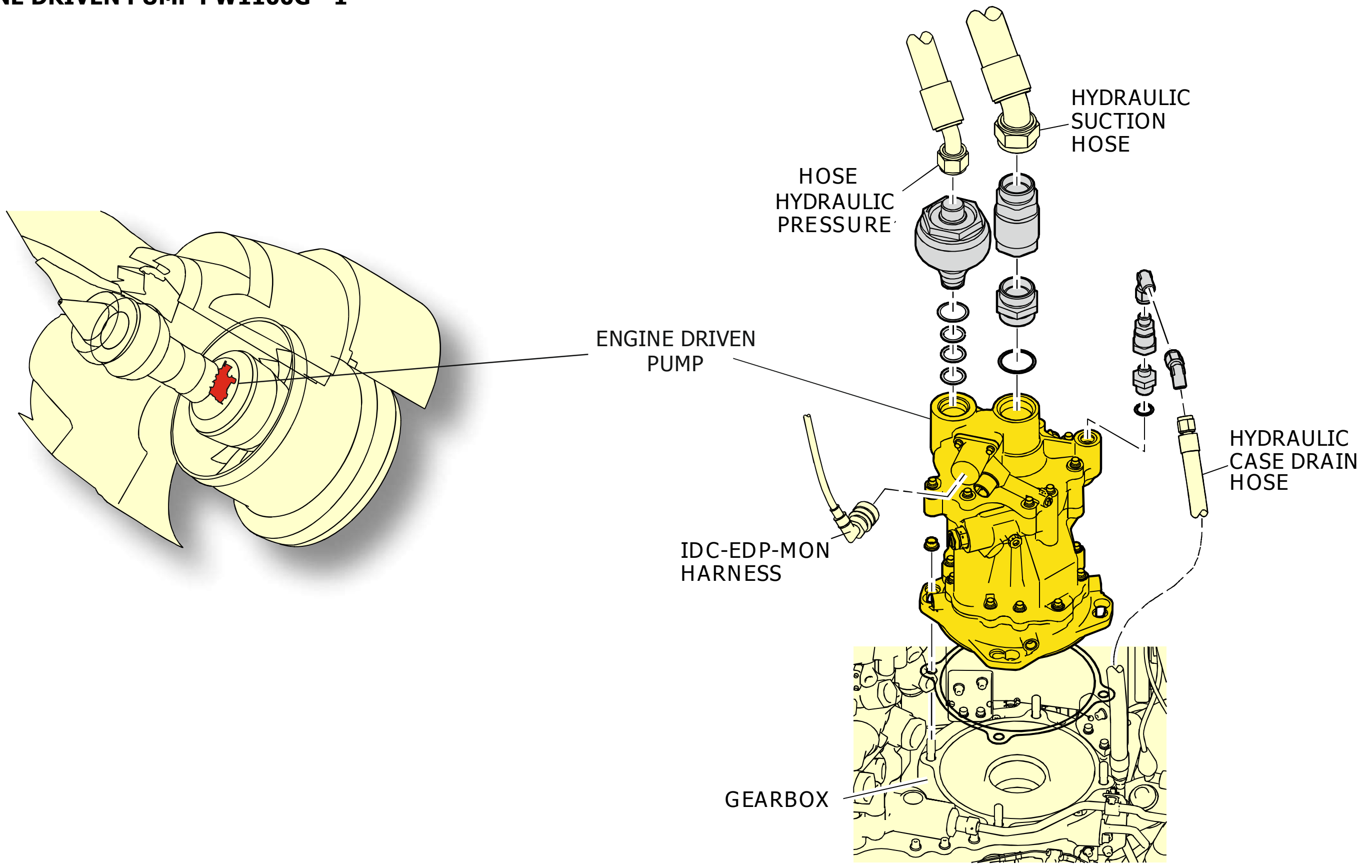
Location

- PW1100G, engine core RHS, 3 o'clock position - mounted vertically.

PTU Inhibition (Not Illustrated)

The temperature inhibition for the PTU has increased to 100°C (from 95°C). Additionally the inhibition logic has changed slightly (inhibited if the aircraft is on the ground, the two engines are in operation and the air speed is low (<50kts).

ENGINE DRIVEN PUMP PW1100G - 1



CASE DRAIN FILTER PW1100G

The Case Drain Filter is located on the LHS of the fan case.

The Case Drain Filter has three main parts:

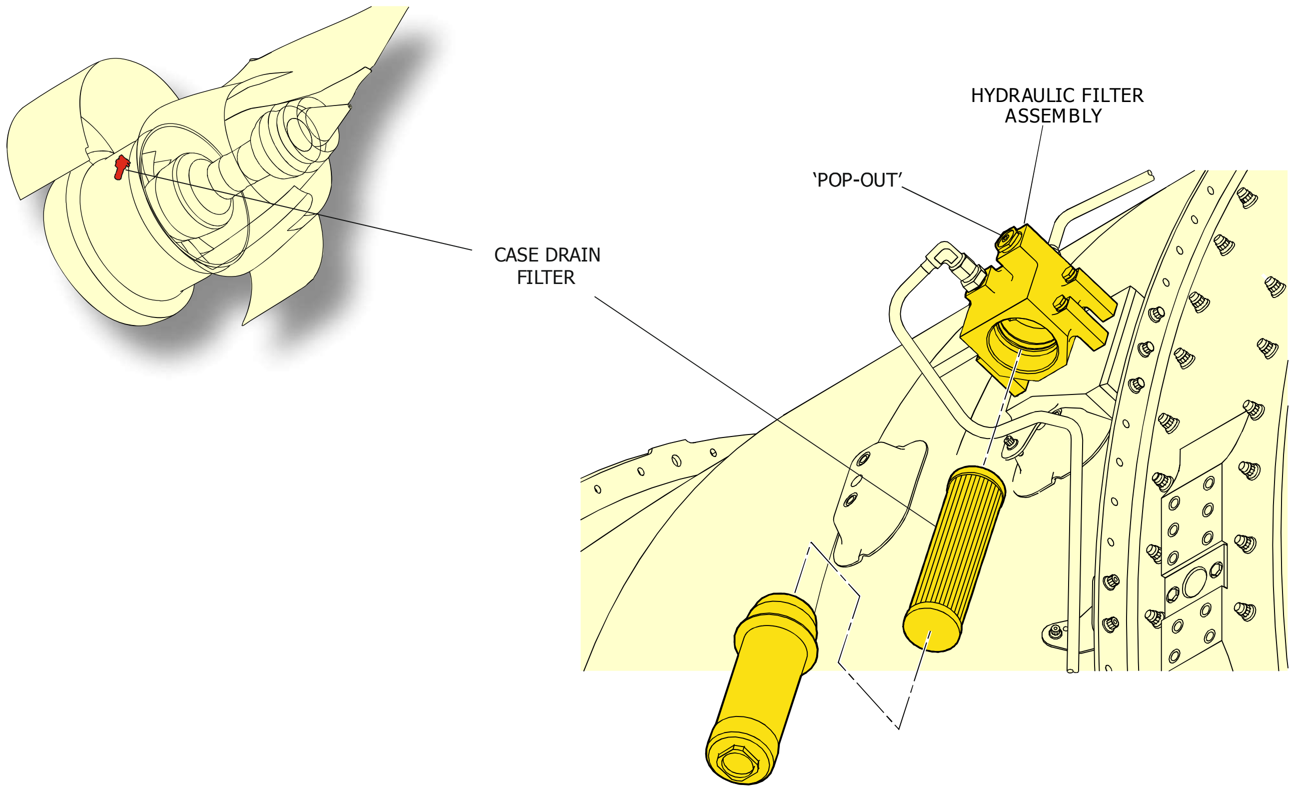
- the filter head,
- the filter bowl,
- the filter element.

The filter head includes the hydraulic connections and the mounting for the attachment of the filter to the structure. The filter head also includes the filter clogging indicator. The clogging indicator is a red pin which comes out to show that the filter element is too dirty. The indicator operates when the pressure differential across the filter is 6.0 + 0.6 - 0.6 bar (87.0 + 8.7 - 8.7 psi). When the red pin is pushed back in, the clogging indicator resets itself. The clogging indicator is latched magnetically. It does not operate if the temperature of the fluid is lower than 0 C° (32 F°). The indicator starts to operate again when the temperature of the fluid increases to 30 C° (86 F°).

An anti-spill device in the filter head operates when the filter element and bowl are removed. It stops fluid coming out of the system or air going in to it when the filter element is changed. The filter does not have a by-pass device to let fluid through if the element is clogged.

The filter bowl holds the filter element. It has a thread to attach it to the filter head. It is not necessary to use tools to tighten the filter bowl in the filter head. The filter element is of the replaceable type. It cannot be cleaned. The filtration rating of the element is 15 microns.

CASE DRAIN FILTER PW1100G- 1



DE-ICING SYSTEM PRESENTATION PW1100G - Level 1

GENERAL

USERS

The Nacelle Anti-Ice (NAI) System is designed to prevent ice formation on the engine inlet which could affect the engine operation. The engine air intake is heated during icing conditions using its related bleed air. The hot air is then discharged overboard.

SOURCE

Hot air for the Nacelle anti-ice system is supplied by a dedicated HP Compressor (HPC) bleed:

- On the PW1100G, 6^{th} stage.

VALVE

The NAI System is controlled and monitored by the Propulsion Control System (PCS) (consisting of the Engine Electronic Controller (EEC) and Engine Interface Unit (EIU)).

Each engine NAI System consists of two electrically controlled, pneumatically operated Pressure Regulating and Shut-Off Valves (PRSOV).

The EEC energizes the solenoid to CLOSE the PRSOV. Therefore, in case of loss of electrical power supply, the valves will go fully open provided the engine bleed air supply pressure is high enough. In the absence of air pressure, the valve is spring-loaded to the closed position.

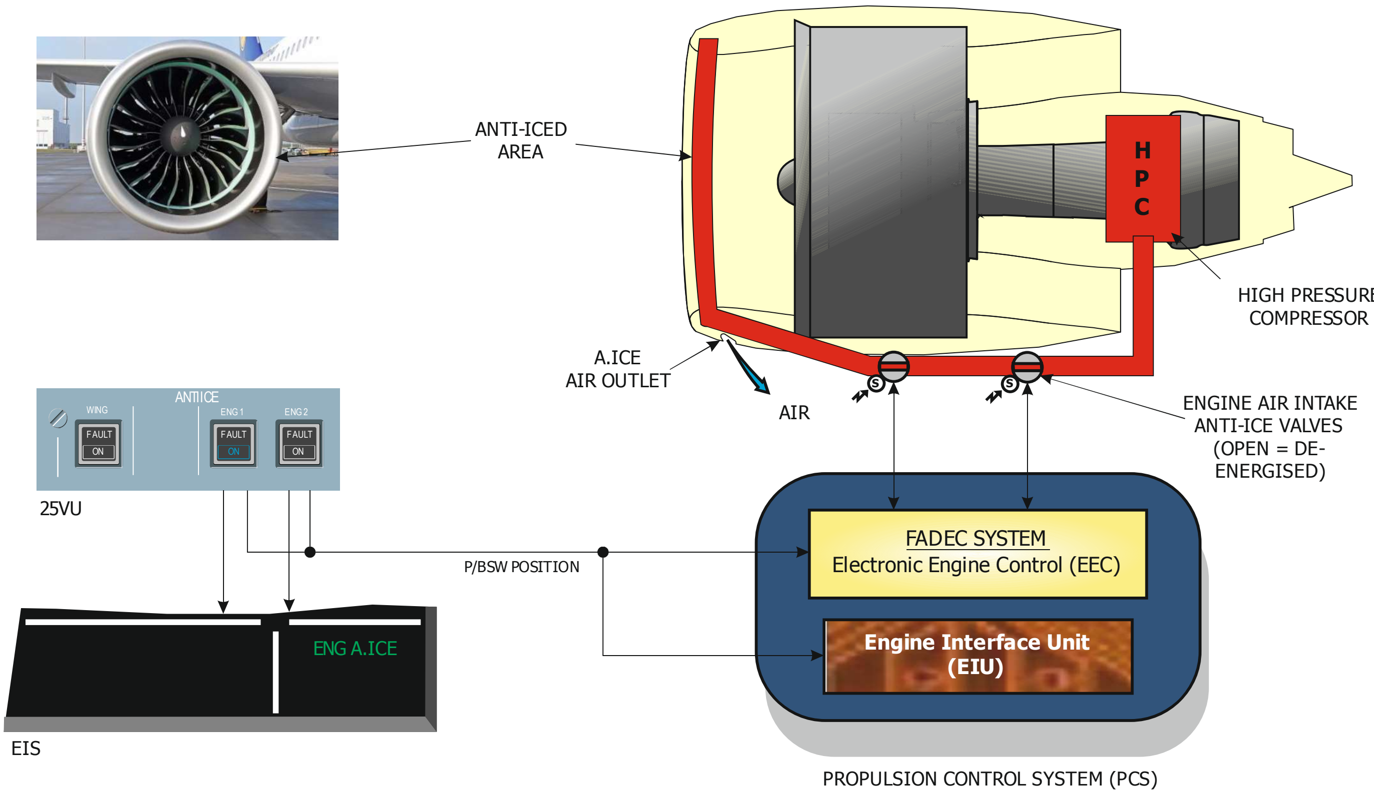
CONTROLS

When the ENG ANTI ICE P/BSW is selected ON, signals are sent to EEC for controlling the valves and to the EIU to calculate the bleed decrements.

ECAM PAGE

If at least one of the two engine air intake anti-ice protection systems is selected ON, a message appears in green on the upper ECAM right MEMO. The EEC monitors the valve position through transducers and processes them to generate necessary indications and warning through the Flight Warning System (FWS). The FAULT indication in the PB S/W is activated by the PCS.

DE-ICING SYSTEM - GENERAL



ENGINE AIR INTAKE ICE PROTECTION SYSTEM DESCRIPTION PW1100G - Level 2 & 3

GENERAL

NAI SYSTEM

Each engine air intake has its own independent Nacelle Anti-Ice (NAI) protection system.

NAI System uses the hot bleed air from a dedicated engine bleed port.

- 6th stage High Pressure Compressor (HPC) for PW1100G.

This bleed air is lead to engine air inlet through a feed duct which passes along the RH side of the engine core and fan case.

Each engine NAI system consists of one command P/B SW but two Pressure Regulating and Shut -Off Valves (PRSOVs) for good operability, two pressure Transducers (PTs), temperature protection and supply ducts.

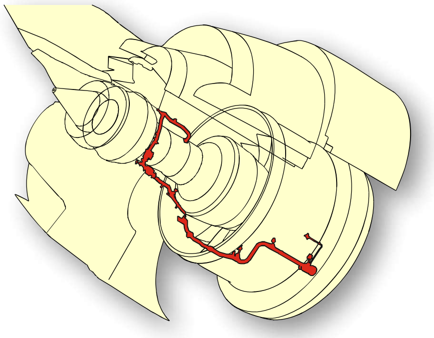
Both PRSOVs are located on the engine core.

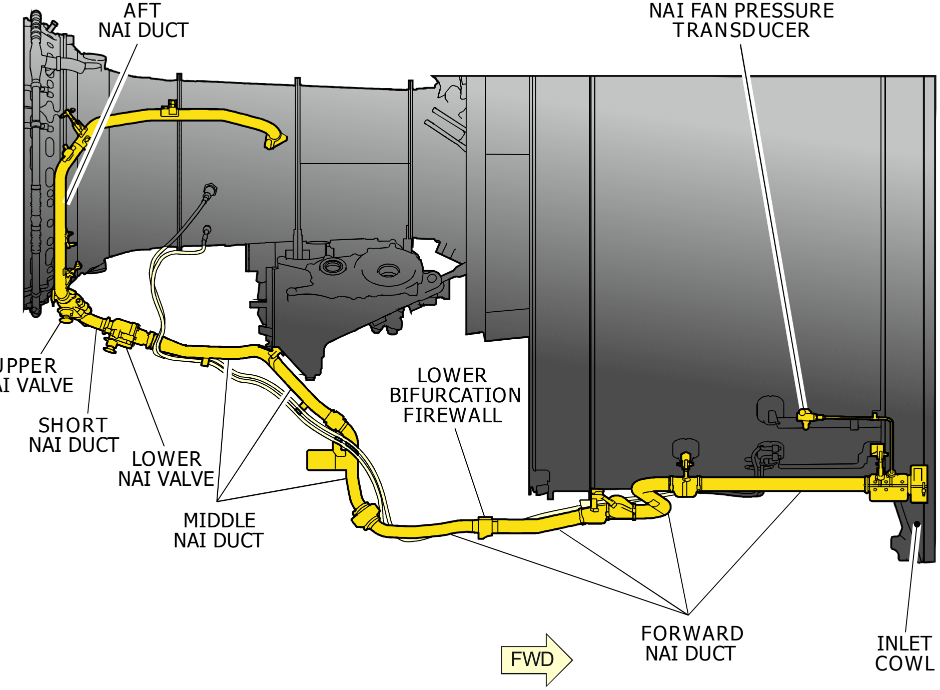
- Right Hand (RH) side, 5 o'clock for PW1100G.

The two PRSOVs are in series.

They can be locked open independently for MEL dispatch purposes. Access is through panels located in the cold stream of the 'C' duct.

ENGINE AIR INTAKE ICE PROTECTION SYSTEM DESCRIPTION (PW1100G)



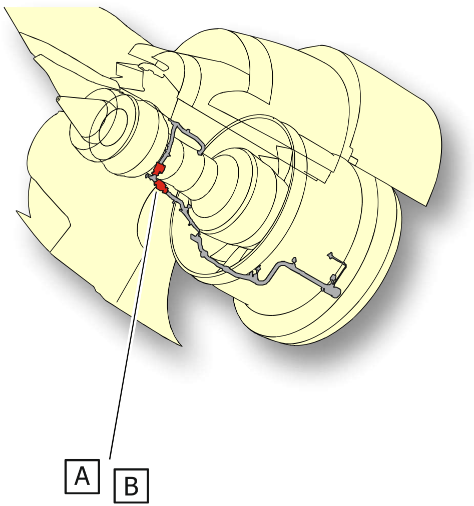


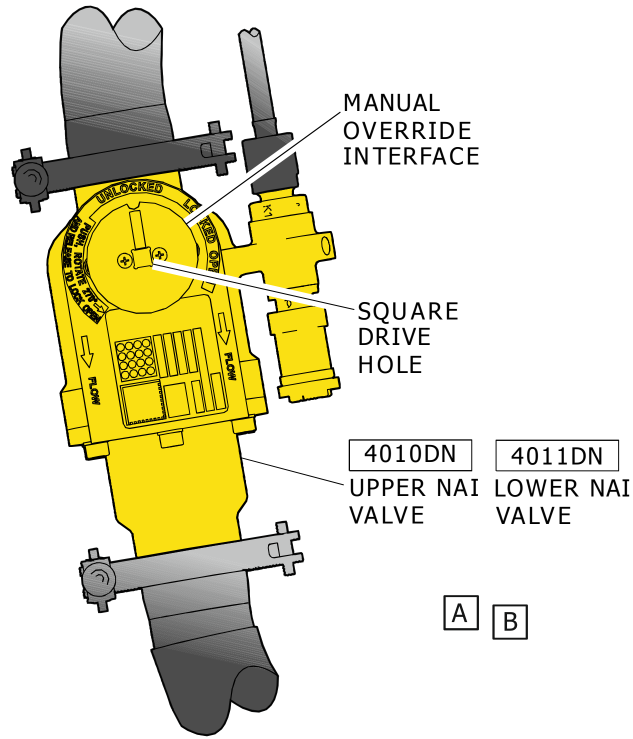
Pressure Regulating and Shut-Off Valves (PRSOV)

The PRSOVs are installed in the core zone. They have a regulation function and an ON/OFF function. If a duct breaks in the fan zone, the PRSOVs also have an isolation function.

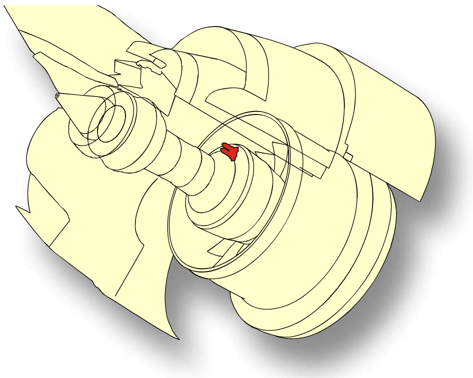
The two solenoids that control the primary functions (ON/OFF) are also installed in the core zone but in a colder area because of the temperature level at the valve location. The two solenoids are installed on the same solenoid manifold and the valve is connected to the solenoid through a sense line.

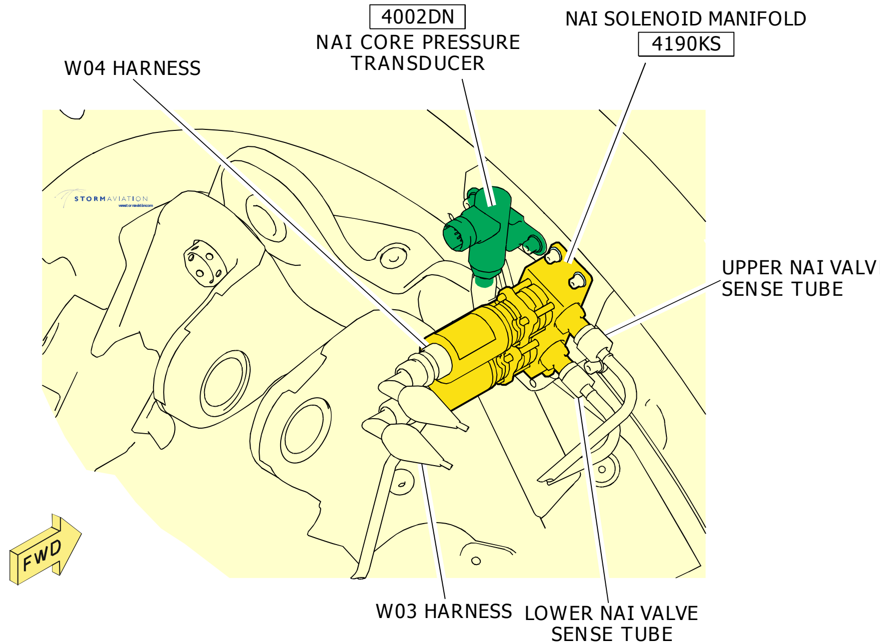
ENGINE AIR INTAKE NACELLE ANTI-ICE VALVES (PW1100G) - 1



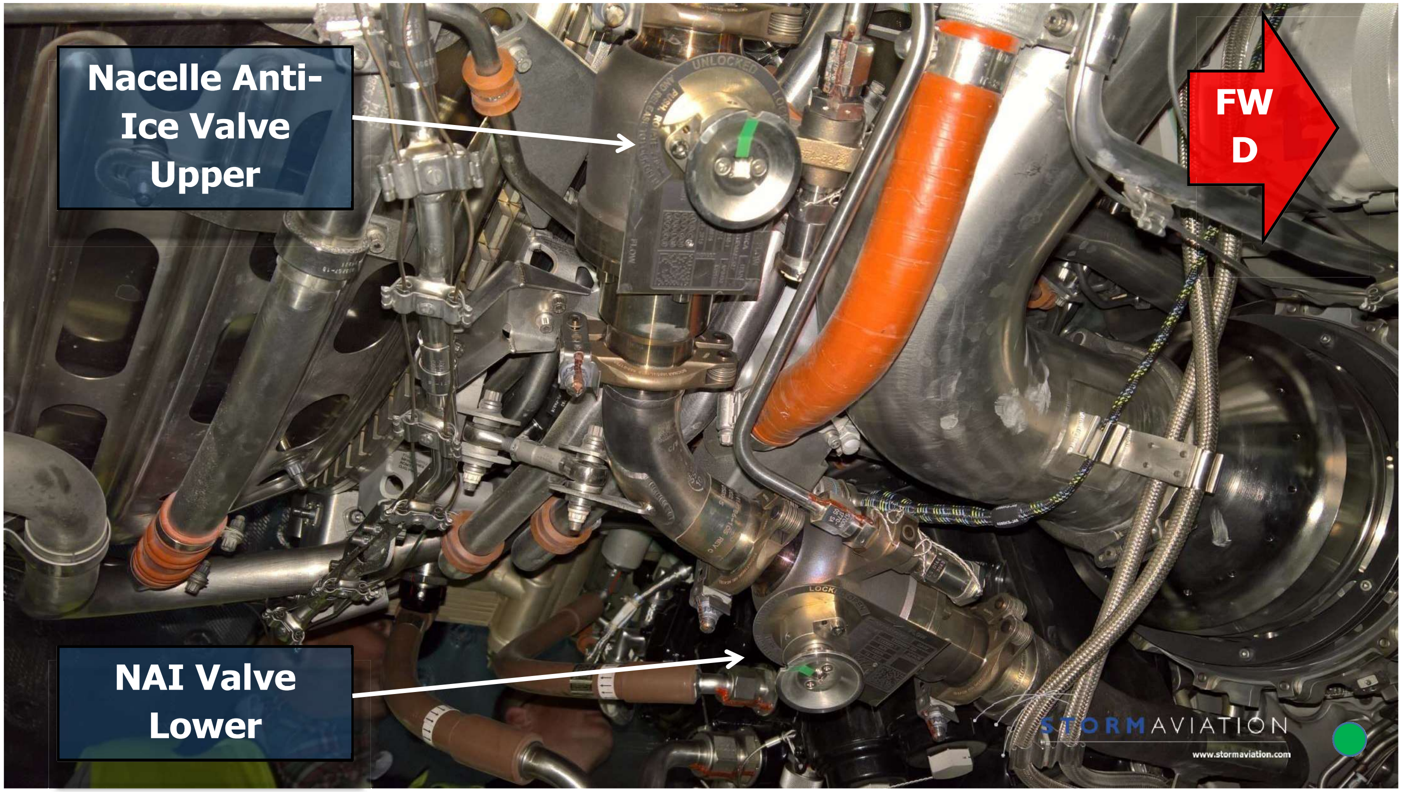


ENGINE ANTI-ICE - TRANSDUCER & CONTROL SOLENOIDS PW1100G - 2





ENGINE AIR INTAKE NACELLE ANTI-ICE VALVES PW1100G - 3

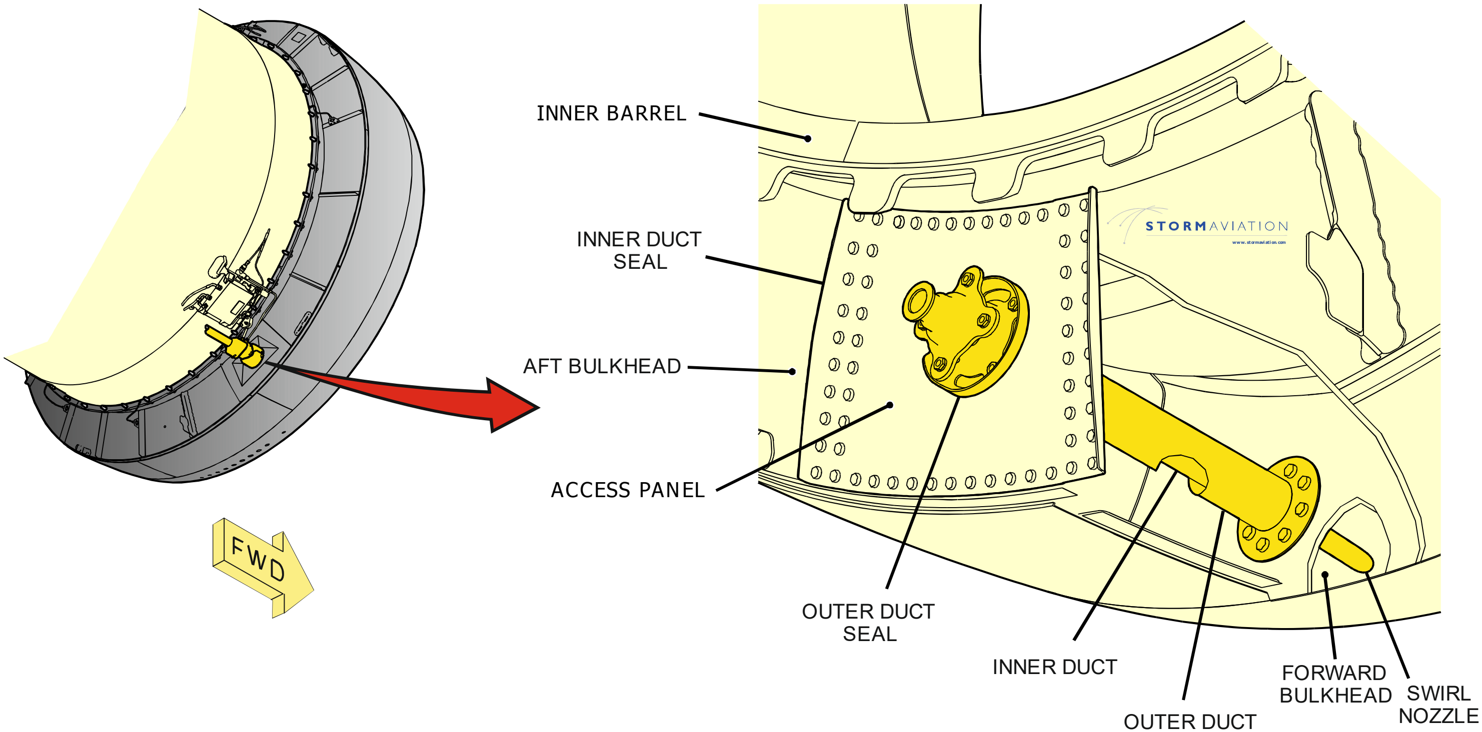


ENGINE AIR INTAKE ICE PROTECTION SYSTEM DESCRIPTION - continued

AIR INLET COWL

The air is released into the air intake lip (D-Duct) through a swirl system which mixes the air and injects it in a specific pattern for effective heating. The airflow exits the air intake lip by a single exhaust grid at the bottom of the nacelle outside the fan which has 6 oval holes.

ENGINE AIR INTAKE AIR INTAKE COWL PW1100G



PRSOV CONTROL AND OPERATION PW1100G

GENERAL

The NAI system is controlled and monitored by the Propulsion Control System (PCS) (Engine Electronic Controller (EEC) and Engine Interface Unit (EIU)).The EEC controls the PRSOV operation by energizing/de-energizing the solenoids. PRSOV 1 is controlled by EEC Channel A and PRSOV 2 is controlled by Channel B. Each PRSOV pneumatically regulates the downstream air pressure.

When the NAI PB S/W is selected to 'ON' position, the EEC de-energizes the solenoid valves of PRSOV to OPEN the valves. Only when both the valves are open the bleed air is fed to the engine intake lip.

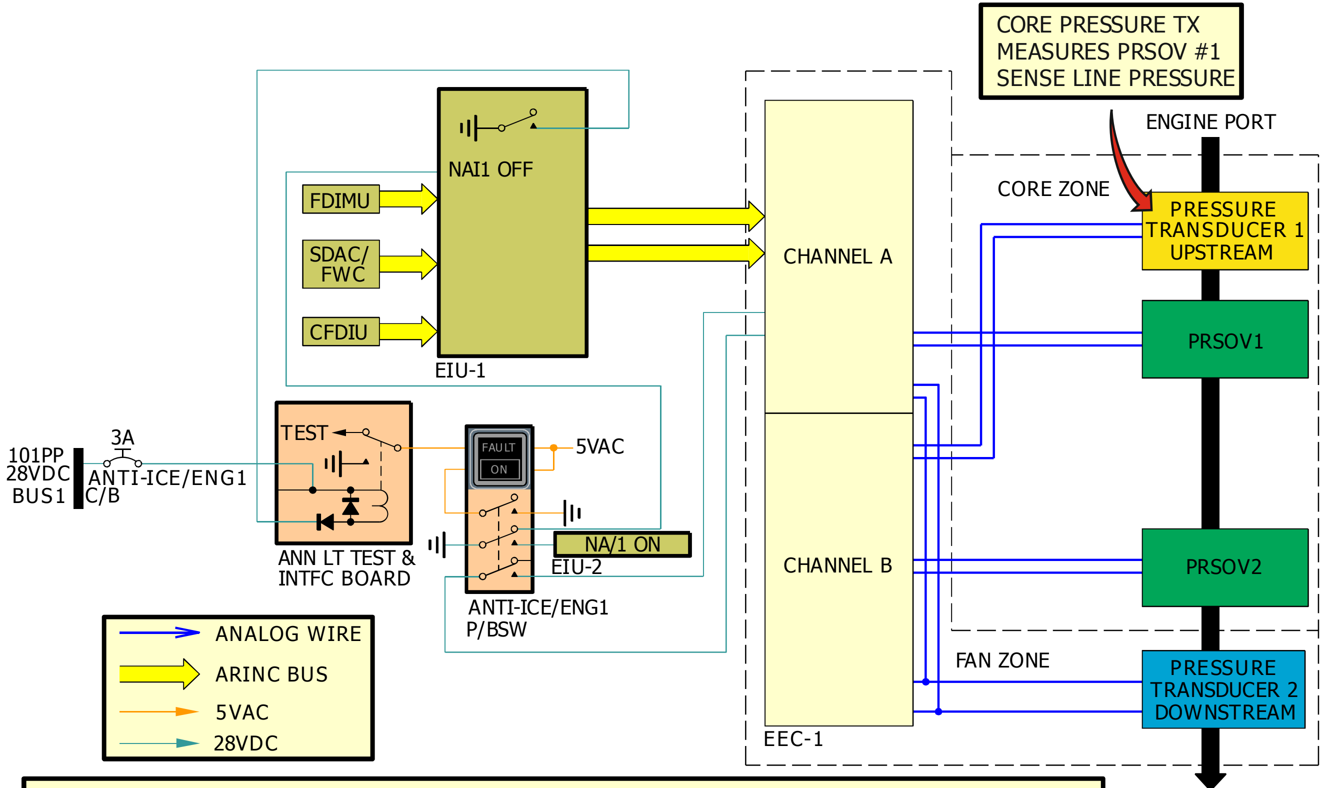
Normal Operating Mode

In normal aircraft operation, the FWS calculates and shows the memo messages on the lower ECAM:

- On the overhead control and indication panel, on the ANTI ICE section when the ENG1(2) pushbutton is pushed the ON legend is on, and on the lower ECAM DU the ENG 1. ICE memo is shown.
- The two solenoids are de-energized and thus the two PRSOVs are in the open and regulating position. The regulating thresholds of each PRV is set to have only the upstream valve in regulation condition in the normal "NAI ON" mode.

On the overhead control and indication panel, on the ANTI ICE section when the ENG1(2) pushbutton is released the ON legend is off, the upper valve solenoid is energized and thus the upper PRSOV is in the closed position through the EEC logic.

PRSOV CONTROL, OPERATION AND MONITORING - PW1100G



NOTE: UPSTREAM PRESSURE TRANSDUCER ALSO KNOW AS CORE PRESSURE TRANSDUCER
NOTE: DOWNSTREAM PRESSURE TRANSDUCER ALSO KNOW AS FAN PRESSURE TRANSDUCER

MONITORING PW1100G

Core Pressure Transducer

The first pressure transducer is installed in the core compartment near the solenoid manifold. This prevents exposure to the high temperatures around the valve.

The upstream pressure transducer measures the downstream valve sense-line pressure. There is one single channel (only connected to EEC channel B), because of the pressure information that is consolidated with the downstream pressure transducer.

Fan Pressure Transducer

The second pressure transducer is installed downstream of PRSOV2 (downstream valve) in the fan compartment, near the interface with the inlet (above the single ignition unit).

The downstream pressure transducer senses the pressure downstream of the two PRSOVs. It is a dual-channel sensor connected to the EEC to keep the monitoring function if a failure of the EEC channel occurs.

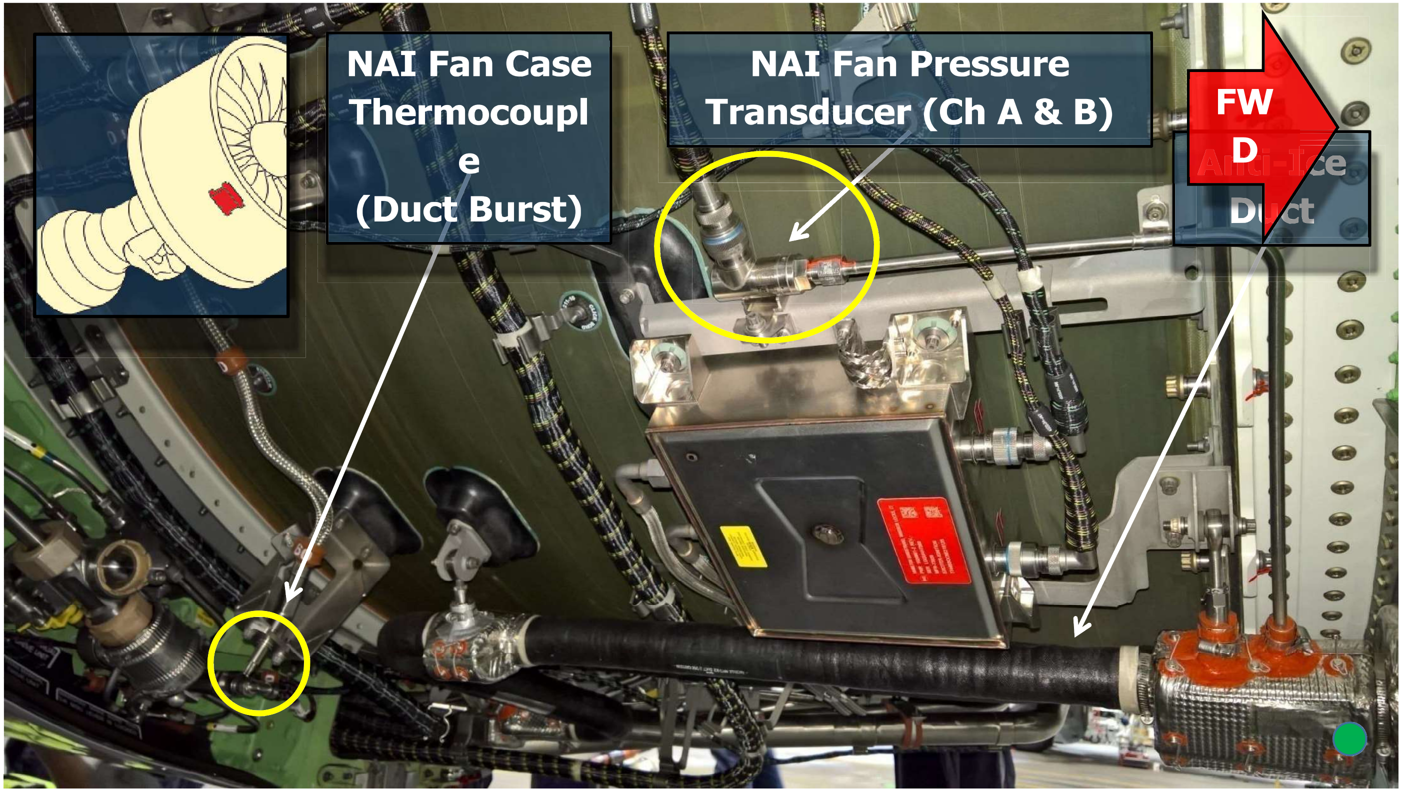
Fan Case Thermocouple

A dual temperature sensor located in the fan case, provides the EEC (one per channel) with the fan compartment temperature measurement for NAI leakage detection.

- 5 o'clock PW1100G.

When the engine is running and a "Hot Air Leakage" event is detected, the EEC energizes PRSOVs solenoids, which provide the isolation function.

MONITORING - FAN CASE COMPONENTS



ENGINE ANTI ICE P/BSW

The P/B SW sends a discrete signal to the EEC to operate the PRSOVs. The P/B SW position and the opposite engine P/B SW position are monitored by the EIU for computing the bleed decrements.

The "FAULT" light is triggered by the EIU based on the input from EEC. It appears when the engine is running and NAI is failed in OPEN or CLOSED. It also appears in case of monitoring fault.

Propulsion Control System (PCS) (EEC and EIU)

The EEC controls the PRSOV to open when the P/B SW is set to ON. The EEC monitors the position of the PRSOV by the two NAI transducers to trigger associated fault messages.

The System Data Acquisition Concentrator/Flight Warning System (SDAC/FWS), Flight Data Interface and Management Unit (FDIMU) and Centralized Fault Display Interface Unit (CFDIU) interfaces with the PCS.

FAILURE CONDITION

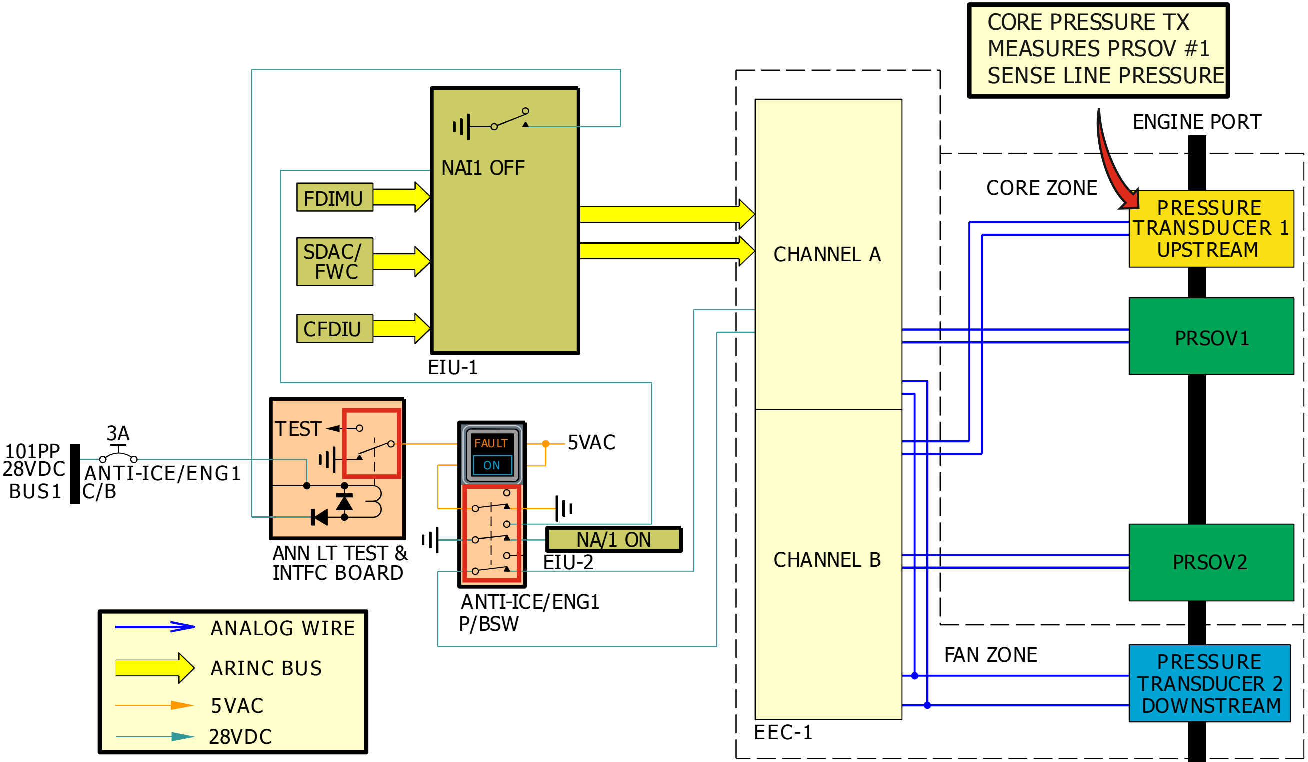
The fail safe position of the valves in case of EEC dual channel failure is OPEN.

In case of a single valve failure, the corresponding valve being failed open, the anti-ice function is still available.

The two pressure Transducers (PT1 for core zone and PT2 for fan zone) monitors leak or burst scenarios and a dual fan case thermocouple helps in identifying over temperature conditions due to leaks or burst. The EEC monitors the same and generates warning messages to the FWS. A hot air leak causes the EEC to energise the PRSOVs closed.

Minimum Equipment List (MEL) - The aircraft can be dispatched with one valve locked open on each engine (ref 30-21-01).

PRSOV CONTROL, OPERATION AND MONITORING PW1100G



NOTE: UPSTREAM PRESSURE TRANSDUCER ALSO KNOW AS CORE PRESSURE TRANSDUCER
NOTE: DOWNSTREAM PRESSURE TRANSDUCER ALSO KNOW AS FAN PRESSURE TRANSDUCER

PRSOV MEL DEACTIVATION PW11OOG

THE PRSOVS CAN BE SET IN THE FOLLOWING POSITIONS:

- Unlocked - normal position
- Locked open - MEL dispatch position (REF MEL 30-21-01B)

CAUTION: YOU CANNOT DEACTIVATE BOTH VALVES OPEN. DAMAGE TO EQUIPMENT MAY OCCUR. ONE VALVE MUST BE ACTIVE FOR FLIGHT.

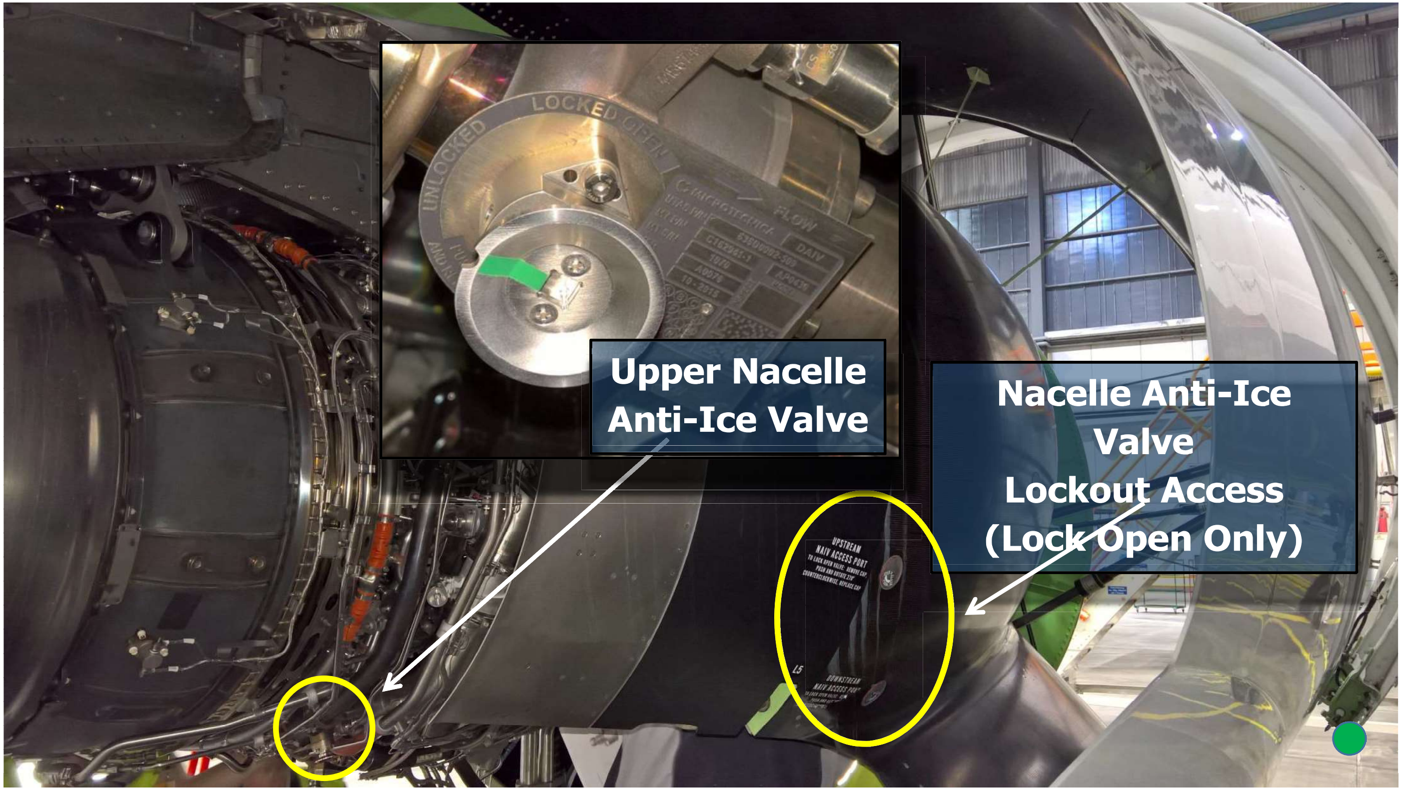
Remove the associated access plug using a screwdriver and turning 90° anti-clockwise. The access plug is secured to the duct by a lanyard.

CAUTION: DO NOT USE TOO MUCH FORCE WHEN REMOVING THE LOCKOUT PLUG IN THE 'C' DUCT COLD STREAM. DAMAGE MAY OCCUR.

The PRSOV can then be unlocked using 1/4 IN square drive by turning 270° anti-clockwise.

Note: You cannot lock the PRSOV in the closed position.

PRSOV DEACTIVATION PW1100G - UNLOCK OPEN



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